SOIL SURVEY OF

Slope County, North Dakota

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
North Dakota Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1967 to 1973. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1973. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the North Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Bowman-Slope and Slope-Hettinger Soil Conservation Districts.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils in Slope County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map soil areas are outlined and identified by symbols. All areas marked with the same symbol have the same kind of soil.

Finding and Using Information

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have slight limitations for a given use can be colored green, those that have moderate limitations can be colored yellow, and those that have severe limitations can be colored red.

Farmers can learn about use and management of the soils from the soil descriptions, from the discussions of the capability units, and from information in the sections "Cropland," "Range," "Woodland," and "Windbreaks and Environmental Plantings."

Foresters can refer to the section "Woodland," where the kinds of trees in the county are described, and the section "Windbreaks and Environmental Plantings," where the soils in the county are grouped according to their suitability for trees.

Game managers and others can find information about the suitability of soils for wildlife habitat and for recreation in the sections "Wildlife Habitat" and "Recreation."

Engineers and builders can find, under "Engineering" and "Soil Properties," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Ranchers can find, under "Range," the names of many of the plants that grow on each soil and estimates of potential yields of range forage.

Scientists can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Slope County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: Stripcropping, contour stripcropping, and grassed waterways help control soil blowing on these soils which are in capability unit IIIe–6. A windbreak protects the farmstead, feedlots, and farmyard from prevailing winds and from blowing snow in winter. Photo courtesy of W. P. Sebens, former executive secretary, North Dakota Association of Soil Conservation Districts.

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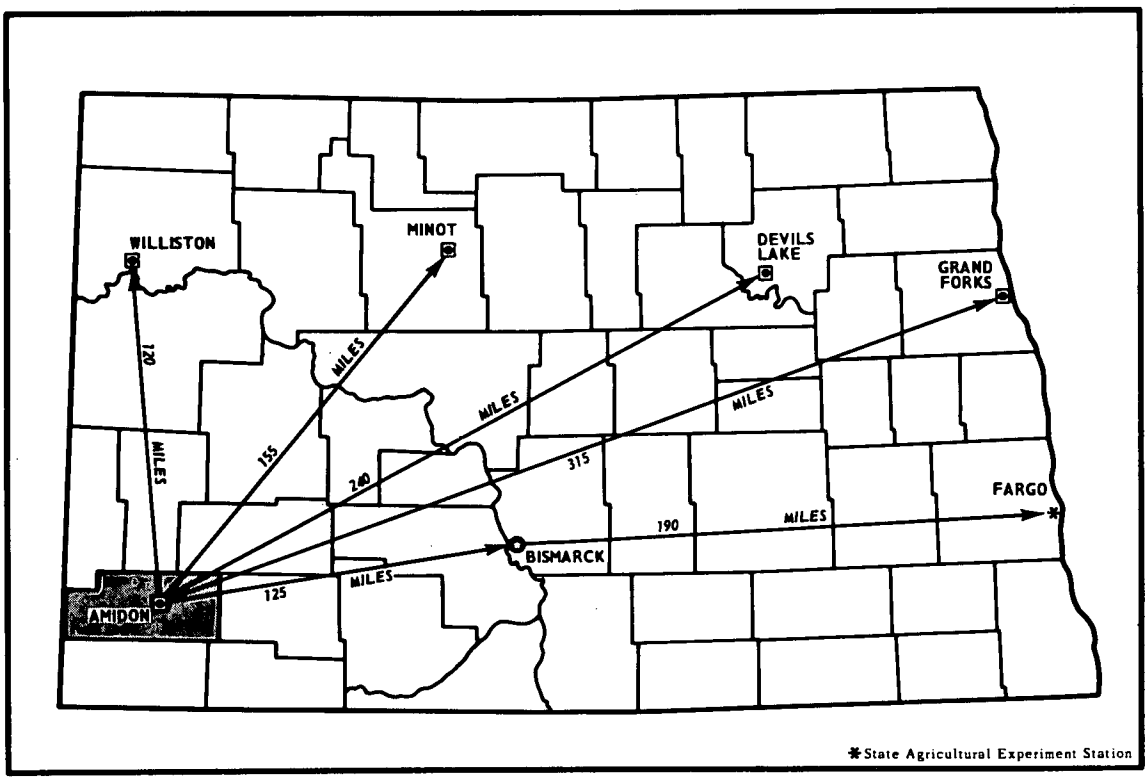

Location of Slope County in North Dakota.

SOIL SURVEY OF SLOPE COUNTY, NORTH DAKOTA

By Kenneth W. Thompson, assisted by Richard Kukowski, Donald Opdahl, Bertram Baker, Cornelius Farris, M. Robert Wright, Lawrence Haugen, Soil Scientists, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with North Dakota Agricultural Experiment Station

SLOPE COUNTY is in the southwestern part of North Dakota. It is bounded on the west by Montana; on the south by Bowman and Adams Counties; on the north by Golden Valley, Billings, and Stark Counties; and on the east by Hettinger County. It has an area of 783,808 acres, or about 1,225 square miles. The climate is semiarid. Agriculture is the main enterprise in the county. Amidon, the county seat, had a population of 54 in 1970, and Marmarth, the only other town in the county, had a population of 247. In 1970, the county's population was 1,484. More detailed information about the county can be found in the section "General Nature of the County."

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a detailed soil map are called mapping units. Some mapping units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Mapping units are discussed in the section "Descriptions of the Soils."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General Soil Map

The general soil map at the back of this publication shows, in color, the soil associations in the survey area. A soil association is a unique natural landscape that has a distinct pattern of soils and of relief and drainage. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in other associations but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one association differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soil associations in this survey area have been grouped into general kinds of landscapes for interpretive purposes. Each of the broad groups and the soil associations in it are described on the following pages.

The terms for texture used in the descriptive headings of the associations refer to the texture of the surface layer. For example, in the heading for the Chama-Cabbart-Sen association, "medium textured" refers to the texture of the surface layer of the Chama, Cabbart, and Sen soils.

Nearly Level to Moderately Sloping Soils on Terraces, Alluvial Fans, and Bottom Land

The soils in this group are adjacent to the Little Missouri River and are in other generally small areas in most parts of the county. They are deep, moderately well drained to somewhat excessively drained, and coarse textured to medium textured. Most areas are used for grass for livestock or for wheat.

1. Hanly-Chanta-Glendive association

Moderately well drained to somewhat excessively drained, deep soils that are moderately coarse, coarse, and medium textured

This association consists of soils on flood plains and terraces of the Little Missouri River.

This association occupies about 5 percent of the county. It is about 14 percent Hanly soils, 12 percent Chanta soils, 10 percent Glendive soils, and 64 percent minor soils.

Hanly soils are deep and moderately coarse textured and are on bottom land. The surface layer is light brownish gray loamy fine sand or sandy loam about 5 inches thick. The underlying material is loamy sand and loamy fine sand.

Chanta soils have slightly convex and plane slopes. They are deep and medium textured. The surface layer is grayish brown loam about 6 inches thick. The subsoil is grayish brown, brown, and light brownish gray loam. Gravel and sand are at a depth of about 26 inches.

Glendive soils have slightly convex and plane slopes. They are deep and moderately coarse textured. The surface layer is light brownish gray fine sandy loam about 7 inches thick. The underlying material is stratified fine sandy loam and loamy fine sand.

Of minor extent in this association are Havre, Zeona, Cabbart, and Kremlin soils and Badland. Havre, Zeona, and Kremlin soils are in a complex pattern in close association with Hanly, Chanta, and Glendive soils. Badland and Cabbart soils are on breaks and uplands.

Chanta and Glendive soils are medium in fertility, and Hanly soils are low in fertility. Chanta and Hanly soils are moderate in organic-matter content, and Glendive soils are moderately low. The available water capacity of Chanta and Hanly soils is low, and that of Glendive soils is moderate. The main concerns of management are controlling grazing and soil blowing and conserving moisture.

Most areas of this association are used for grazing; the main enterprise is ranching. These soils are well suited to irrigation.

2. Stady-Shambo-Mott association

Well drained, deep soils that are medium textured and moderately coarse textured

This association consists of soils on alluvial fans and terraces. The soils are mostly nearly level to gently sloping, but some are moderately sloping.

This association occupies about 6 percent of the county. It is about 28 percent Stady soils, 9 percent Shambo soils, 8 percent Mott soils, and 55 percent minor soils.

Stady soils have convex slopes. They are deep and medium textured. The surface layer is dark grayish brown loam about 6 inches thick. The subsoil is brown and grayish brown loam. Sand and gravel are at a depth of about 29 inches.

Shambo soils have slightly concave and plane slopes. They are deep and medium textured. The surface layer is dark grayish brown loam about 9 inches thick. The subsoil is brown and grayish brown loam. Sand and gravel are at a depth of about 41 inches.

Mott soils have slightly convex and plane slopes. They are deep and medium textured and moderately coarse textured. The surface layer is grayish brown sandy loam or loam about 6 inches thick. The subsoil is brown and very pale brown sandy loam and fine sandy loam. Loamy coarse sand is at a depth of about 46 inches.

Minor soils in this association are the Amor, Arnegard, Belfield, Daglum, Manning, and Wabek soils, and the Lawther variant. These soils are in a complex pattern in close association with Stady, Shambo, and Mott soils.

Mott soils are low in fertility, Stady soils are medium in fertility, and Shambo soils are high in fertility. Mott soils are low in organic-matter content, and Shambo and Stady soils are moderate. The available water capacity of Stady soils is low, that of Mott soils is moderate, and that of Shambo soils is high. The main concerns of management are conserving moisture, controlling soil blowing and water erosion, and maintaining tilth and fertility.

Most areas of this association are used for cultivated crops. The main enterprises are diversified grain farming and raising of livestock. Wheat is the main cash crop. Some areas are used for grazing beef cattle. Some areas are suited to irrigation.

Nearly Level to Strongly Sloping Soils on Uplands

The soils in this group are in areas throughout the county. They are deep and moderately deep, moderately well drained and well drained, and medium textured to fine textured. Most areas are used for small grain or for grass for livestock.

3. Absher-Belfield-Rhoades association

Moderately well drained and well drained, deep soils that are medium, moderately fine, and fine textured

This association consists of gently sloping soils on plains that are characterized by pitted microrelief.

This association occupies about 5 percent of the county. It is about 18 percent Absher soils, 12 percent

Belfield soils, 12 percent Rhoades soils, and 58 percent minor soils.

Absher soils have slightly concave and plane slopes and are on uplands. They are deep and medium textured and moderately fine textured. The surface layer is grayish brown loam or clay loam. The subsoil is a claypan of grayish brown silty clay. Soft sedimentary beds are at a depth of about 41 inches.

Belfield soils have slightly concave and plane slopes. They are deep and medium textured and moderately fine textured. The surface layer is grayish brown silt loam or silty clay loam about 8 inches thick. The subsoil is a claypan of grayish brown and light olive brown silty clay and silty clay loam. The underlying material is silty clay loam.

Rhoades soils have slightly concave and plane slopes and are on uplands. They are deep and medium textured, moderately fine textured, and fine textured. The surface layer is typically grayish brown loam, silt loam, silty clay loam, or silty clay. The subsoil is dark grayish brown and grayish brown silty clay loam 27 inches thick. The underlying material is silty clay loam and silty clay. Shale is at a depth of 53 inches.

Minor soils in this association are the Patent, Cherry, Flasher, Cabba, Harriet, and Cabbart soils. Harriet soils are in a complex pattern in close association with Absher and Belfield soils. Patent and Cherry soils are on alluvial fans, foot slopes, and terraces. Cabba, Flasher, and Cabbart soils are on ridges and hilltops.

Absher and Rhoades soils are low in fertility, and Belfield soils are medium in fertility. The Absher soils are low in organic-matter content, and Belfield and Rhoades soils are moderate. The available water capacity of all these soils is moderate. The main concerns of management are conserving moisture, controlling grazing, and maintaining fertility.

Most areas of this association are used for grazing. The main enterprise is ranching.

4. Belfield-Rhoades-Moreau association

Moderately well drained and well drained, deep and moderately deep soils that are medium, moderately fine, and fine textured

This association consists of undulating soils on plains. A few areas are hilly and have complex, short slopes that are dissected by intermittent streams. In places the landscape has pitted microrelief.

This association occupies about 20 percent of the county. It is about 30 percent Belfield soils, 11 percent Rhoades soils, 9 percent Moreau soils, and 50 percent minor soils.

Belfield soils have slightly concave and plane slopes. They are deep and medium textured and moderately fine textured. The surface layer is grayish brown silt loam or silty clay loam about 8 inches thick. The subsoil is a claypan of grayish brown and light olive brown silty clay and silty clay loam. The underlying material is silty clay loam.

Rhoades soils have slightly concave and plane slopes. They are deep and moderately fine textured, medium textured, and fine textured. The surface layer is grayish brown loam, silt loam, silty clay loam, or silty clay about 3 inches thick. The subsoil is a claypan of dark grayish brown and grayish brown silty clay loam. Soft sedimentary shale beds are at a depth of about 53 inches.

Moreau soils have slightly convex and plane slopes. They are moderately deep and fine textured. The surface layer is grayish brown silty clay about 6 inches thick. The subsoil is grayish brown and light yellowish brown silty clay. Soft sedimentary shale is at a depth of about 29 inches.

Minor soils in this association are the Amor, Reeder, Sen, Chama, Cabba, Morton, Regent, Daglum, Ekalaka, Harriet, Arnegard, Grail, Grassna, Lawther, Savage, Vebar, Tally, and Flasher soils. Most of these soils are in a complex pattern in close association with Belfield, Rhoades, and Moreau soils. Arnegard, Grail, Grassna, Lawther, and Savage soils are in low swales and concave areas. Cabba, Flasher, Vebar, and Tally soils are on ridges and hilltops.

Belfield and Moreau soils are medium in fertility, and Rhoades soils are low in fertility. Belfield, Moreau, and Rhoades soils are moderate in organic-matter content. The available water capacity of these soils is moderate. The main concerns of management are controlling soil blowing and erosion, conserving moisture, controlling grazing, maintaining fertility, and maintaining and improving tilth.

The cultivated soils in this association are used for small grain, alfalfa, and corn. The main enterprises are diversified grain farming and livestock raising. Wheat is the main cash crop. Some areas are in native grass and are used for range.

5. Morton-Regent-Sen association

Well drained, moderately deep soils that are medium textured and moderately fine textured

This association consists of undulating soils on uplands that are dissected by swales and drainageways. These soils are mostly gently sloping to moderately sloping.

This association occupies about 7 percent of the county. It is about 23 percent Morton soils, 13 percent Regent soils, 13 percent Sen soils, and 51 percent minor soils.

Morton soils have slightly convex and plane slopes. They are moderately deep and medium textured and moderately fine textured. The surface layer is grayish brown silt loam or silty clay loam about 8 inches thick. The subsoil is grayish brown and pale yellow silty clay loam. Soft sedimentary shale beds are at a depth of about 36 inches.

Regent soils have slightly convex and plane slopes. They are moderately deep and moderately fine textured. The surface layer is grayish brown silty clay loam about 6 inches thick. The subsoil is grayish brown silty clay about 8 inches thick. Below this the soil material is light gray silty clay. Soft sedimentary shale beds are at a depth of about 36 inches.

Sen soils have slightly convex and plane slopes. They are moderately deep and medium textured. The surface layer is grayish brown silt loam about 6 inches thick.

The subsoil is grayish brown and light yellowish brown silt loam. Soft sedimentary beds are at a depth of about 34 inches.

Minor soils in this association are the Moreau, Belfield, Savage, and Korchea soils. Moreau and Belfield soils are in a complex pattern in close association with Morton, Regent, and Sen soils; Savage soils are in swales; and Korchea soils are on terraces.

Morton soils are high in fertility, and Regent and Sen soils are medium in fertility. All of the soils are moderate in organic-matter content. The available water capacity of Morton soils is moderate to high, and that of Sen and Regent soils is high. The main concerns of management are controlling soil blowing and erosion, conserving moisture, controlling grazing, and maintaining tilth and fertility.

Most areas of this association are used for cultivated crops. Small grain, corn, and alfalfa grow well on the soils. Wheat is the main cash crop. The main enterprises are diversified grain farming and livestock raising. Some areas are used for grazing of beef cattle.

Nearly Level to Very Steep Soils on Uplands

The soils in this group are in areas throughout the county. They are deep to shallow, well drained to excessively drained, and medium textured to coarse textured. Most areas are used for grass for livestock; a few are used for small grain.

6. *Chama-Cabbart-Sen association*

Well drained to excessively drained, moderately deep and shallow soils that are medium textured

This association consists of undulating soils on uplands that are dissected by swales and drainageways. These soils are mostly gently sloping, but they are steeper along drainageways.

This association occupies about 2 percent of the county. It is about 28 percent Chama soils, 18 percent Cabbart soils, 18 percent Sen soils, and 36 percent minor soils.

Chama soils have slightly convex and plane slopes. They are moderately deep and medium textured. The surface layer typically is grayish brown silt loam about 4 inches thick. The subsoil is grayish brown and light gray silt loam. Soft sedimentary beds are at a depth of about 34 inches.

Cabbart soils have convex slopes and are on ridge crests. They are shallow and medium textured. The surface layer is light olive brown silt loam about 2 inches thick. Below this is a layer of light yellowish brown silt loam about 8 inches thick. Soft siltstone bedrock is at a depth of about 10 inches.

Sen soils have slightly convex and plane slopes. They are moderately deep and medium textured. The surface layer is grayish brown silt loam about 6 inches thick. The subsoil is grayish brown and light yellowish brown silt loam. Soft sedimentary beds are at a depth of about 34 inches.

Minor soils in this association are Boxwell and Kremlin soils. Boxwell soils are on uplands, and Kremlin soils are on alluvial fans and terraces.

Cabbart soils are low in fertility, and Chama and Sen soils are medium in fertility. Cabbart soils are low in organic-matter content, and Chama and Sen soils are moderate. The available water capacity is low in Cabbart soils, moderate in Chama soils, and high in Sen soils. The main concerns of management are controlling erosion, proper range use, conserving moisture, and maintaining fertility.

Most areas of this association and almost all Cabbart soils are used for native range. The cultivated soils in this association are used for small grain. Wheat is the main cash crop. The main enterprise is ranching.

7. *Badland-Cabbart association*

Excessively drained, shallow soils that are medium textured and Badland

This association consists of rough land, or breaks, mainly along the Little Missouri River and its tributaries. Slopes are mostly steep to very steep. Shale and sandstone outcrops are common.

This soil association occupies about 21 percent of the county. It is about 28 percent Badland, 15 percent Cabbart soils, and 57 percent minor soils.

Badland consists of steep and very steep areas on uplands that are undergoing geologic erosion. The areas are characterized by cone-shaped knobs, buttes, and escarpments. About 30 to 85 percent of the surface is barren or sparsely vegetated.

Cabbart soils have convex slopes and are on ridge crests. They are shallow and medium textured. The surface layer is light olive brown silt loam about 2 inches thick. Below this is a layer of light yellowish brown silt loam about 8 inches thick. Soft siltstone bedrock is at a depth of about 10 inches.

Minor soils in this association include Fleak, Patent, and Sham soils. Fleak soils are on uplands; Patent and Sham soils are on alluvial fans, foot slopes, and terraces.

Cabbart soils are low in fertility and in organic-matter content. They have a low available water capacity. The main concerns of management are controlling grazing and improving range.

The soils in this association are not suited to cultivation. They are used only for range and hay and as wildlife habitat. Grazing is difficult in some areas of Badland because of steep slopes. The main enterprise is ranching.

8. *Brandenburg-Cabba-Cabbart association*

Well drained to excessively drained, shallow soils that are medium textured

This association consists of gently sloping to very steep soils on ridges and rough breaks. Most of the ridges are capped with porcellanite or scoria.

This association occupies about 6 percent of the county. It is about 35 percent Brandenburg soils, 33 percent Cabba soils, 15 percent Cabbart soils, and 17 percent minor soils.

Brandenburg soils are on ridge crests and tops of buttes. They are shallow and medium textured. The surface layer is brown channery loam about 10 inches thick. The underlying material is porcellanite beds.

Cabba soils are on convex side slopes and ridge crests. They are shallow and medium textured. The surface layer is grayish brown loam or silt loam about 4 inches thick. Below this are layers of light gray loam

and silt loam. Soft sedimentary beds are at a depth of about 17 inches.

Cabbart soils have convex slopes and are on ridge crests. They are shallow and medium textured. The surface layer is light olive brown silt loam about 2 inches thick. Below this is a layer of light yellowish brown silt loam about 8 inches thick. Soft siltstone bedrock is at a depth of about 10 inches.

Of minor extent in this association are areas of Badlands on steep to very steep uplands that are undergoing geologic erosion.

The soils in this association are low in fertility and in organic-matter content. The available water capacity of Cabba and Cabbart soils is low, and that of Brandenburg soils is very low. The main concerns of management are controlling grazing and improving range.

Most areas of this association are used for range and as wildlife habitat. The main enterprise is ranching.

9. *Chama-Cabba-Sen association*

Well drained and excessively drained, moderately deep and shallow soils that are medium textured

This association consists of undulating soils on uplands that are dissected by swales and drainageways. Most of the soils are gently sloping and moderately sloping, but some are nearly level to very steep.

This association occupies about 15 percent of the county. It is about 20 percent Chama soils, 9 percent Cabba soils, 9 percent Sen soils, and 62 percent minor soils.

Chama soils have slightly convex and plane slopes. They are moderately deep and medium textured. The surface layer typically is grayish brown silt loam about 4 inches thick. The subsoil is grayish brown and light gray silt loam. Soft sedimentary beds are at a depth of about 34 inches.

Cabba soils are on convex side slopes and ridge crests. They are shallow and medium textured. The surface layer is grayish brown loam or silt loam about 4 inches thick. Below this are layers of light gray loam and silt loam. Soft sedimentary beds are at a depth of about 17 inches.

Sen soils have slightly convex and plane slopes. They are moderately deep and medium textured. The surface layer is grayish brown silt loam about 6 inches thick. The subsoil is grayish brown and light yellowish brown silt loam. Soft sedimentary beds are at a depth of about 34 inches.

Minor soils in this association are Golva, Korchea, Grassna, and Morton soils. Golva, Grassna, and Korchea soils are on swales and terraces; Morton soils are on uplands in close association with Chama and Sen soils.

Chama and Sen soils are medium in fertility, and Cabba soils are low in fertility. Chama and Sen soils are moderate in organic-matter content and Cabba soils are low. The available water capacity is high in Sen soils, moderate in Chama soils, and low in Cabba soils. The main concerns of management are controlling grazing, and maintaining tilth and fertility.

Most areas of this association are used for cultivated crops. Small grain, corn, and alfalfa grow well on the soils of this association. Wheat is the main cash crop. Some areas are used for grazing of beef cattle. The main enterprises are diversified grain farming and raising of livestock.

10. *Flasher-Badland-Cabba association*

Somewhat excessively drained and excessively drained, shallow soils that are moderately coarse, coarse, and medium textured and Badland

This association consists of gently sloping to very steep soils and Badland on uplands and breaks. Sandstone outcrops are common.

This association occupies about 2 percent of the county. It is about 15 percent Flasher soils, 15 percent Badland, 14 percent Cabba soils, and 56 percent minor soils.

Flasher soils have convex slopes and are on hilltops and ridge crests. They are shallow and moderately coarse textured and coarse textured. The surface layer is grayish brown sandy loam, loamy fine sand, or fine sandy loam about 5 inches thick. Below this are layers of light yellowish brown loamy sand and light gray fine sand. Soft sedimentary sandstone is at a depth of about 15 inches.

Badland consists of steep and very steep areas on uplands that are undergoing geologic erosion. The areas are characterized by cone-shaped knobs, buttes, and escarpments. About 30 to 85 percent of the surface is barren or sparsely vegetated.

Cabba soils are on convex side slopes and ridge crests. They are shallow and medium textured. The surface layer is grayish brown loam or silt loam about 4 inches thick. Below this are layers of light gray loam and silt loam. Soft sedimentary beds are at a depth of about 17 inches.

Of minor extent in this association are Patent and Mott soils and Borolls and Orthents, stony. Patent and Mott soils are on alluvial fans, foot slopes, and terraces; and Borolls and Orthents, stony, are directly below the highest escarpment of buttes.

The soils in this association are low in fertility and in organic-matter content. The available water capacity of Flasher soils is very low, and that of Cabba soils is low. The main concerns of management are controlling water erosion, controlling grazing, and improving range.

The soils in this association are not suited to cultivation. They are used only for range and as wildlife habitat. Grazing is difficult in some areas because of steepness. The main enterprise is ranching.

11. *Fleak-Rhame-Zeona association*

Well drained and excessively drained, deep, moderately deep, and shallow soils that are coarse textured and moderately coarse textured

This association consists of nearly level to very steep soils on plains, ridges, and rough breaks. The nearly level and gentle slopes are commonly short.

This association occupies about 3 percent of the county. It is about 23 percent Fleak soils, 12 percent Rhame soils, 12 percent Zeona soils, and 53 percent minor soils.

Fleak soils are gently sloping to very steep and are on hilltops and ridge crests. They are shallow and are moderately coarse textured and coarse textured. The surface layer is grayish brown loamy fine sand or fine

loam about 4 inches thick. Below this is a layer of light gray loamy fine sand. Soft sedimentary sandstone is at a depth of about 19 inches.

Rhame soils are on convex side slopes and are gently sloping to strongly sloping. They are moderately deep and moderately coarse textured. The surface layer is grayish brown fine sandy loam about 5 inches thick. The subsoil is grayish brown and light brownish gray fine sandy loam. Soft sedimentary sandstone is at a depth of about 35 inches.

Zeona soils are nearly level to moderately sloping and are on terraces and uplands. They are deep and coarse textured. The surface layer is light brownish gray loamy fine sand about 5 inches thick. Below this is light brownish gray and light gray fine sand about 55 inches thick.

Of minor extent in this association are Chinook soils and Badland.

Badland consists of steep to very steep areas on uplands that are undergoing geologic erosion. Chinook soils are in a complex pattern in close association with Fleak and Rhame soils.

Rhame soils are medium in fertility, and Fleak and Zeona soils are low in fertility. Rhame soils are moderate in organic-matter content, Fleak soils are low, and Zeona soils are very low. The available water capacity of Rhame soils is moderate, and that of Fleak and Zeona soils is low. The main concerns of management are controlling soil blowing and conserving moisture.

Most areas of this association are used for range. Some Rhame and Zeona soils that have slopes of less than 9 percent are cultivated. Wheat is the main cash crop. The main enterprise is ranching.

12. Verbar-Tally-Flasher association

Well drained and somewhat excessively drained, deep, moderately deep, and shallow soils that are coarse textured and moderately coarse textured

This association consists of nearly level to very steep soils on plains, ridges, and knolls. Most of the soils are sloping to moderately sloping.

This association occupies about 8 percent of the county. It is about 23 percent Vebar soils, 12 percent Tally soils, 11 percent Flasher soils, and 54 percent minor soils.

Vebar soils have convex and plane slopes. They are moderately deep and moderately coarse textured. The surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is fine sandy loam. Soft sedimentary sandstone is at a depth of about 36 inches.

Tally soils have slightly convex and plane slopes. They are deep and moderately coarse textured. The surface layer is dark grayish brown fine sandy loam about 10 inches thick. The subsoil is fine sandy loam. Loamy fine sand is at a depth of about 42 inches.

Flasher soils have convex slopes and are on hilltops and ridge crests. They are shallow and moderately coarse textured and coarse textured. The surface layer is grayish brown sandy loam, loamy fine sand, or fine sandy loam about 5 inches thick. Below this are layers of light yellowish brown loamy sand and light gray fine sand. Soft sedimentary sandstone is at a depth of about 15 inches.

Minor soils in this association are Parshall, Telfer, and Belfield soils. Parshall soils are in low swales and on concave positions; Telfer soils are in close association with Tally soils; and Belfield soils are in swales and on foot slopes.

Vebar and Tally soils are medium in fertility, and Flasher soils are low in fertility. Vebar and Tally soils are moderate in organic-matter content, and Flasher soils are low. The available water capacity of Vebar soils is low to moderate, that of Tally soils is moderate, and that of Flasher soils is very low. The main concerns of management are controlling soil blowing, conserving moisture, and maintaining fertility.

Most areas of this association are used for cultivated crops, but a few hilly and steep areas are used for range or as wildlife habitat. Flasher soils are not suited to cultivated crops. Wheat is the main cash crop. The main enterprises are diversified grain farming and raising of livestock.

Descriptions of the Soils

This section describes each soil series in detail and then, briefly, each mapping unit in that series. Unless stated otherwise, what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

The mapping units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

The descriptions together with the soil maps can be useful in determining the potential of soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each mapping unit, or soil, is given in the section "Use and Management of the Soils."

Soils that have profiles that are almost alike make up a *soil series*. A profile is the sequence of horizons, or layers, from the surface down to rock or other underlying material. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Desart series, for example, was named for the former rural community of Desart in Slope County.

The soil profile is an important part of the description of each soil series. The profile of each soil series is described twice. The first description is brief and in terms familiar to a layman. The second is more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Chama silt loam, 3 to 6 percent slopes, is one of several phases within the Chama series.

Some mapping units are made up of two or more dominant kinds of soil. Such mapping units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Chama-Cabba silt loams, 6 to 9 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. No soil associations were mapped in Slope County.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Benz and Absher clay loams, 1 to 9 percent slopes, is an undifferentiated group in this survey area.

Most mapping units include small, scattered areas of soils other than those that appear in the name of the mapping unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the mapping unit. These soils are described in the description of each mapping unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Not all mapping units are members of a soil series. For example, Lawther clay, sandy subsoil variant, 1 to 3 percent slopes, does not belong to a soil series; nevertheless, it is listed in alphabetic order along with the soil series.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Badland is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed.

The names of some soils mapped in Slope County differ from those in published surveys of adjacent counties. This is due to changes in concepts of soil series or in the application of the system for classifying soils, or it is due to the small extent of the soils in some series.

The acreage and proportionate extent of each mapping unit are given in table 1, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary and in the Soil Survey Manual (*3*).[1]

Absher Series

The Absher series consists of deep, moderately well drained to well drained, nearly level to moderately sloping claypan soils on fans, terraces, and uplands. These soils are medium textured and moderately fine textured. They formed in alluvium and soft shale.

In a representative profile the surface layer is grayish brown loam about 2 inches thick. The subsurface layer is light brownish gray loam about 8 inches thick. The subsoil, about 13 inches thick, is grayish brown silty clay. The lower part is calcareous at a depth of about 7 inches. The underlying material is calcareous, grayish brown silty clay loam about 23 inches thick overlying soft sedimentary beds.

Permeability is very slow, and the available water capacity is moderate. Organic-matter content and fertility are low.

Most areas of these soils are in pasture or range. A few small areas are cultivated, and a few are used for hay. Where these soils are cultivated, the surface layer is dispersed and puddled. They are better suited to grasses than to other crops.

Representative profile of Absher loam, 1 to 3 percent slopes, in native grassland 2,000 feet north of the center of sec. 35, T. 134 N., R. 105 W.

A1—0 to 2 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure and medium and fine granular; soft, friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

A2—2 to 5 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak fine subangular blocky structure parting to thin platy; soft, friable, nonsticky and nonplastic; mildly alkaline; abrupt smooth boundary.

B21t—5 to 7 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium and coarse columnar structure parting to moderate medium angular blocky; hard, very firm, sticky and plastic; common thin clay films on peds; mildly alkaline; clear wavy boundary.

B22t—7 to 12 inches; grayish brown (2.5Y 5/2)

[1] Italic numbers in parentheses refer to References, p. 167.

TABLE 1.—*Acreage and proportionate extent of the soils*

Map symbol	Soil name	Acres	Percent	Map symbol	Soil name	Acres	Percent
AbA	Absher loam, 1 to 3 percent slopes	3,050	0.4	DaC	Daglum fine sandy loam, 6 to 9 percent slopes	403	0.1
AbC	Absher loam, 3 to 9 percent slopes	13,600	1.7	DhB	Daglum-Rhoades silty clay loams, 1 to 6 percent slopes	8,300	1.1
AgA	Amor loam, 1 to 3 percent slopes	880	0.1	Dk	Dimmick silty clay	1,550	0.2
AgB	Amor loam, 3 to 6 percent slopes	6,300	0.8	EdB	Ekalaka-Desart fine sandy loams, 1 to 6 percent slopes	2,000	0.3
AgC	Amor loam, 6 to 9 percent slopes	4,000	0.5	EkB	Ekalaka soils, 1 to 6 percent slopes	3,600	0.5
ArB	Arnegard loam, 3 to 6 percent slopes	830	0.1	EkC	Ekalaka soils, 6 to 9 percent slopes	680	0.1
BaF	Badland-Cabbart complex, 9 to 50 percent slopes	28,500	3.6	FaA	Farland silt loam, 1 to 3 percent slopes	4,800	0.6
Bb	Badland	5,800	0.7	FaB	Farland silt loam, 3 to 6 percent slopes	1,000	0.1
BeA	Belfield silt loam, 1 to 3 percent slopes	19,500	2.5	FbE	Flasher-Badland complex, 9 to 40 percent slopes	1,050	0.1
BeB	Belfield silt loam, 3 to 6 percent slopes	13,400	1.7	FhD	Flasher soils, 3 to 15 percent slopes	6,800	0.9
BfA	Belfield silty clay loam, 1 to 3 percent slopes	10,000	1.3	FhE	Flasher soils, 15 to 40 percent slopes	2,950	0.4
BfB	Belfield silty clay loam, 3 to 6 percent slopes	2,150	0.3	FkE	Fleak-Badland complex, 9 to 40 percent slopes	10,000	1.3
BhA	Belfield-Rhoades silty clay loams, 1 to 3 percent slopes	7,500	1.0	FlD	Fleak soils, 3 to 15 percent slopes	7,400	0.9
BhB	Belfield-Rhoades silty clay loams, 3 to 6 percent slopes	2,400	0.3	FlE	Fleak soils, 15 to 40 percent slopes	8,300	1.1
BkC	Benz silt loam, 1 to 9 percent slopes	1,000	0.1	Fu	Fluvaquentic Haplaquolls	1,250	0.2
BnC	Benz and Absher clay loams, 1 to 9 percent slopes	5,200	0.7	GlA	Glendive fine sandy loam, 1 to 3 percent slopes	6,300	0.8
Bo	Borolls, saline	3,000	0.4	GlB	Glendive fine sandy loam, 3 to 6 percent slopes	940	0.1
BrE	Borolls and Orthents, stony, 15 to 45 percent slopes	3,950	0.5	GoC	Golva silt loam, 6 to 9 percent slopes	2,150	0.3
BtB	Boxwell loam, 3 to 6 percent slopes	800	0.1	GrA	Grail silt loam, 1 to 3 percent slopes	2,650	0.3
BtC	Boxwell loam, 6 to 9 percent slopes	900	0.1	GrB	Grail silt loam, 3 to 6 percent slopes	880	0.1
BuE	Brandenburg-Cabba complex, 6 to 40 percent slopes	33,500	4.3	GtA	Grail silty clay loam, 1 to 3 percent slopes	3,200	0.4
CaE	Cabba loam, 15 to 40 percent slopes	3,300	0.4	GtB	Grail silty clay loam, 3 to 6 percent slopes	720	0.1
CbE	Cabba-Badland complex, 9 to 40 percent slopes	12,000	1.5	GwA	Grassna silt loam, 1 to 3 percent slopes	13,000	1.7
CcD	Cabba-Chama complex, 9 to 15 percent slopes	16,600	2.1	GxB	Grassna and Golva silt loams, 3 to 6 percent slopes	8,500	1.1
CdD	Cabba-Chama stony loams, 3 to 20 percent slopes	1,100	0.1	HaA	Hanly soils, 1 to 3 percent slopes	7,900	1.0
CfC	Cabbart silt loam, 3 to 9 percent slopes	3,500	0.4	Hc	Harriet complex	10,500	1.3
CfD	Cabbart silt loam, 9 to 15 percent slopes	11,900	1.5	HeA	Havre soils, 1 to 3 percent slopes	6,900	0.9
CfE	Cabbart silt loam, 15 to 40 percent slopes	6,100	0.8	Hz	Heil and McKenzie soils	2,050	0.3
CgE	Cabbart-Badland complex, 9 to 40 percent slopes	61,000	7.8	KcA	Korchea loam, 1 to 3 percent slopes	5,500	0.7
CmA	Chama silt loam, 1 to 3 percent slopes	2,000	0.3	Kh	Korchea and Havre soils, channeled	14,000	1.8
CmB	Chama silt loam, 3 to 6 percent slopes	13,000	1.7	KrB	Kremlin loam, 1 to 6 percent slopes	3,450	0.4
CoB	Chama-Cabba silt loams, 3 to 6 percent slopes	6,800	0.9	KrC	Kremlin loam, 6 to 9 percent slopes	580	0.1
CoC	Chama-Cabba silt loams, 6 to 9 percent slopes	24,000	3.1	LaA	Lawther silty clay, 1 to 3 percent slopes	3,750	0.5
CoD	Chama-Cabba silt loams, 9 to 15 percent slopes	6,000	0.8	LaB	Lawther silty clay, 3 to 6 percent slopes	760	0.1
CrC	Chama-Cabbart silt loams, 6 to 9 percent slopes	5,400	0.7	Lc	Lawther-Rhoades silty clays	2,300	0.3
CtA	Chanta loam, 1 to 3 percent slopes	4,450	0.6	LdA	Lawther clay, sandy subsoil variant, 1 to 3 percent slopes	1,050	0.1
CtB	Chanta loam, 3 to 6 percent slopes	900	0.1	LdC	Lawther clay, sandy subsoil variant, 3 to 9 percent slopes	346	(1)
CyC	Cherry silty clay loam, 3 to 9 percent slopes	1,650	0.2	LeB	Lefor-Vebar fine sandy loams, 1 to 6 percent slopes	1,950	0.2
CzB	Chinook fine sandy loam, 1 to 6 percent slopes	960	0.1	LeC	Lefor-Vebar fine sandy loams, 6 to 9 percent slopes	910	0.1
DaB	Daglum fine sandy loam, 1 to 6 percent slopes	2,150	0.3	MaA	Manning fine sandy loam, 1 to 3 percent slopes	1,500	0.2

TABLE 1.—*Acreage and proportionate extent of the soils*—Continued

Map symbol	Soil name	Acres	Percent
MaB	Manning fine sandy loam, 3 to 6 percent slopes	2,400	0.3
MeA	Moreau silty clay, 1 to 3 percent slopes	6,500	0.8
MeB	Moreau silty clay, 3 to 6 percent slopes	9,200	1.2
MeC	Moreau silty clay, 6 to 9 percent slopes	1,400	0.2
MoA	Morton silt loam, 1 to 3 percent slopes	2,200	0.3
MoB	Morton silt loam, 3 to 6 percent slopes	6,800	0.9
MoC	Morton silt loam, 6 to 9 percent slopes	710	0.1
MpA	Morton complex, 1 to 3 percent slopes	1,700	0.2
MpB	Morton complex, 3 to 6 percent slopes	5,200	0.6
MpC	Morton complex, 6 to 9 percent slopes	650	0.1
MrB	Morton-Rhoades silt loams, 3 to 6 percent slopes	10,600	1.4
MrC	Morton-Rhoades silt loams, 6 to 9 percent slopes	1,900	0.2
MsA	Mott sandy loam, 1 to 3 percent slopes	1,250	0.2
MsB	Mott sandy loam, 3 to 6 percent slopes	1,250	0.2
MtA	Mott loam, 1 to 3 percent slopes	1,100	0.1
MtB	Mott loam, 3 to 6 percent slopes	810	0.1
PaB	Parshall fine sandy loam, 1 to 6 percent slopes	3,700	0.5
PeB	Patent loam, 3 to 6 percent slopes	1,550	0.2
PeD	Patent loam, 6 to 15 percent slopes	5,700	0.7
PsD	Patent-Sham-Gullied land complex, 3 to 15 percent slopes	13,900	1.8
ReA	Reeder loam, 1 to 3 percent slopes	910	0.1
ReB	Reeder loam, 3 to 6 percent slopes	3,300	0.4
ReC	Reeder loam, 6 to 9 percent slopes	700	0.1
RgA	Regent silty clay loam, 1 to 3 percent slopes	2,900	0.4
RgB	Regent silty clay loam, 3 to 6 percent slopes	6,600	0.8
RhA	Regent-Rhoades silty clay loams, 1 to 3 percent slopes	2,800	0.4
RhC	Regent-Rhoades silty clay loams, 3 to 9 percent slopes	7,100	0.9
RkB	Rhame-Chinook fine sandy loams, 3 to 6 percent slopes	1,850	0.2
RkC	Rhame-Chinook fine sandy loams, 6 to 9 percent slopes	1,500	0.2
RmC	Rhame-Fleak fine sandy loams, 6 to 9 percent slopes	1,800	0.2
RmD	Rhame-Fleak fine sandy loams, 9 to 15 percent slopes	1,100	0.1
RsA	Rhoades-Belfield complex, 1 to 3 percent slopes	6,600	0.8
RsC	Rhoades-Belfield complex, 3 to 9 percent slopes	10,400	1.3
RxB	Rhoades complex, 1 to 6 percent slopes	8,900	1.1
SgA	Savage silty clay loam, 1 to 3 percent slopes	3,600	0.5
SgB	Savage silty clay loam, 3 to 6 percent slopes	1,270	0.2
ShA	Savage-Rhoades silty clay loams, 1 to 3 percent slopes	2,900	0.4
SlB	Searing loam, 3 to 6 percent slopes	1,050	0.1
SmB	Searing-Ringling stony loams, 3 to 6 percent slopes	1,700	0.2
SnA	Sen silt loam, 1 to 3 percent slopes	3,800	0.5
SnB	Sen silt loam, 3 to 6 percent slopes	13,500	1.7
SnC	Sen silt loam, 6 to 9 percent slopes	4,800	0.6
SoB	Sen-Golva silt loams, 3 to 6 percent slopes	6,700	0.8
SoC	Sen-Golva silt loams, 6 to 9 percent slopes	1,550	0.2
SrD	Sen and Amor soils, 9 to 15 percent slopes	920	0.1
SsC	Sham complex, 1 to 9 percent slopes	2,800	0.4
StA	Shambo loam, 1 to 3 percent slopes	4,800	0.6
StB	Shambo loam, 3 to 6 percent slopes	5,300	0.7
SyA	Stady loam, 1 to 3 percent slopes	9,900	1.3
SyB	Stady loam, 3 to 6 percent slopes	4,850	0.6
SzC	Stady and Manning soils, 6 to 9 percent slopes	2,750	0.3
TaA	Tally fine sandy loam, 1 to 3 percent slopes	4,350	0.6
TaB	Tally fine sandy loam, 3 to 6 percent slopes	4,950	0.6
TeB	Telfer-Lihen loamy fine sands, 1 to 6 percent slopes	2,000	0.3
TeC	Telfer-Lihen loamy fine sands, 6 to 9 percent slopes	1,000	0.1
VfC	Vebar-Flasher fine sandy loams, 3 to 9 percent slopes	4,150	0.5
VfD	Vebar-Flasher fine sandy loams, 9 to 15 percent slopes	4,750	0.6
VrB	Vebar-Tally fine sandy loams, 3 to 6 percent slopes	14,800	1.9
VrC	Vebar-Tally fine sandy loams, 6 to 9 percent slopes	10,400	1.3
WaE	Wabek loam, 3 to 25 percent slopes	12,800	1.6
WyC	Wayden silty clay, 1 to 9 percent slopes	1,500	0.2
YeE	Yetull loamy coarse sand, 6 to 25 percent slopes	910	0.1
ZfC	Zeona loamy fine sand, 1 to 9 percent slopes	3,300	0.4
	Gravel pits	104	(1)
	Quarry, mine	151	(1)
	Water	534	0.1
	Total	783,808	100.0

[1] Less than 0.1 percent.

silty clay, dark grayish brown (2.5Y 4/2) moist; strong coarse prismatic structure parting to strong coarse and medium angular blocky; hard, very firm, sticky and plastic; common thin clay films on peds; strong effervescence; mildly alkaline; gradual wavy boundary.

B23t—12 to 18 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong coarse and medium angular blocky structure; very hard, very firm, very sticky and plastic; few thin clay films on peds; strong effervescence; mildly alkaline; clear wavy boundary.

C1ca—18 to 25 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; hard, firm, very sticky and plastic; few gypsum crystals; violent effervescence; strongly alkaline; gradual wavy boundary.

C2cs—25 to 41 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse subangular blocky structure; hard, very firm, sticky and plastic; many gypsum crystals; slight effervescence; strongly alkaline; gradual wavy boundary.

C3—41 to 60 inches; stratified sedimentary beds.

The A1 horizon is 2 inches thick or less and ranges from loam to clay loam. The A2 horizon is light brownish gray or grayish brown clay, silty clay, clay loam, silty clay loam, or loam. Structure of the B2 horizon is moderate to strong. Some pedons have segregated lime or gypsum. The C1 and C2 horizons are silty clay loam, clay loam, or silty clay.

Absher soils are near Cabbart and Rhoades soils. They are deeper than Cabbart soils, and they have a thicker surface layer than Rhoades soils.

AbA—Absher loam, 1 to 3 percent slopes. This soil is on uplands, terraces, and fans. It has the profile described as representative of the series. In areas that are in native grass the landscape has a pitted microrelief (fig. 1). The pitted areas are locally known as slick, scab, pan, or gumbo spots. These spots have little or no vegetation, and they absorb water slowly. The surface layer is clay loam or silty clay. In cultivated areas these spots are dispersed and puddled.

Included with this soil in mapping are small areas of Belfield soils on uplands and Absher soils that have a sandy loam or clay loam surface layer.

Runoff is slow, and water ponds in level areas. High content of sodium and poor structure of the subsoil are the main limitations to the use of this soil. The main concern of management is proper range use.

Nearly all areas of this soil are in native range. Capability unit VIs (Thin Claypan); Thin Claypan range site.

AbC—Absher loam, 3 to 9 percent slopes. This soil is on uplands, terraces, and fans. It has a profile similar to the one described as representative of the series, but the surface layer is thinner. In areas that are in native grass the landscape has a pitted microrelief. The pitted areas are locally known as slick, scab, pan, or gumbo spot. They have a surface layer of clay loam or silty clay. They have little or no vegetation and absorb water slowly. They make up 20 to 80 percent of the acreage. In cultivated areas these spots are dispersed and puddled.

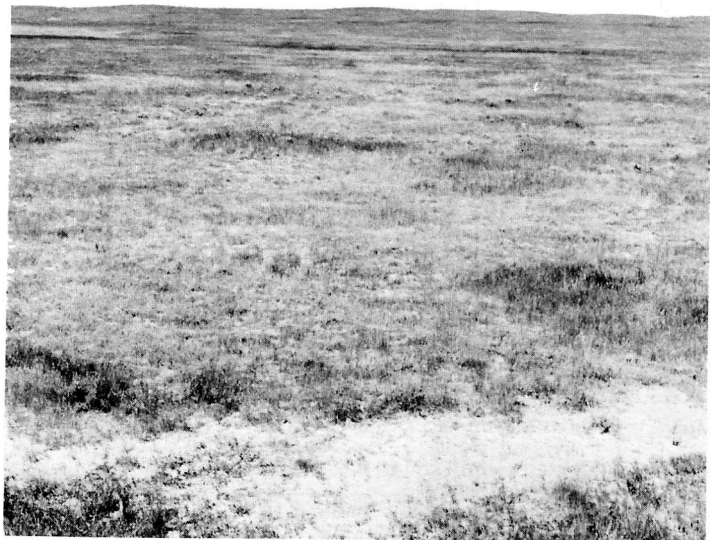

Figure 1.—**This area of Absher loam, 1 to 3 percent slopes, is in the Thin Claypan range site. The light-colored area in the foreground is pitted microrelief.**

Included with this soil in mapping are Belfield, Rhoades, Daglum, and Benz soils on uplands that make up about 35 percent of the mapping unit; Absher soils that have a surface layer that ranges from sandy loam to clay loam; and Cabbart soils on ridges.

Runoff is slow to rapid. Salinity and poor soil structure in the subsoil are the main limitations. The main concern of management is controlling grazing.

Nearly all areas of this soil are in native range. Capability unit VIs (Thin Claypan); Thin Claypan range site.

Amor Series

The Amor series consists of moderately deep, well drained, nearly level to strongly sloping, medium textured soils on uplands. These soils formed in material weathered from soft shale and very fine grained sandstone.

In a representative profile the surface layer is dark grayish brown loam about 5 inches thick. The subsoil is loam about 27 inches thick. In the upper 6 inches it is dark grayish brown; in the next 6 inches it is grayish brown; and in the lower 15 inches it is light brownish gray and light yellowish brown and is slightly calcareous. The underlying material is calcareous soft sedimentary beds.

Permeability and the available water capacity are moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used mostly for crops. Some are in native grasses. These soils are suited to cultivated

crops, trees, and grasses commonly grown in the county.

Representative profile of Amor loam, 3 to 6 percent slopes, in a cultivated field, 1,070 feet west and 630 feet north of the southeast corner of sec. 26, T, 135 N., R. 101 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B21—5 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

B22—11 to 17 inches; grayish brown (2.5Y 5/3) loam, dark grayish brown (2.5Y 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and nonplastic; neutral; gradual wavy boundary.

B3—17 to 32 inches; light brownish gray and light yellowish brown (2.5Y 6/2) loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and nonplastic; slight effervescence; mildly alkaline; gradual wavy boundary.

C1ca—32 to 44 inches; light yellowish brown (2.5Y 6/4) soft siltstone, light olive brown (2.5Y 5/4) moist; moderate thick platy structure; hard, friable, slightly sticky and nonplastic; lime segregated in large-sized soft masses; strong effervescence; moderately alkaline; clear wavy boundary.

C2—44 to 60 inches; light gray (5Y 7/2) soft sandstone, olive gray (5Y 5/2) moist; massive; very soft, very friable, nonsticky and nonplastic; moderately alkaline.

The A horizon is grayish brown or dark grayish brown. The B2 horizon is dark grayish brown, brown, or light olive brown loam or clay loam. The underlying beds are stratified soft siltstone, fine grained sandstone, or shale.

Amor soils are on a landscape similar to that of Cabba, Shambo, and Vebar soils. Amor soils are deeper to soft shale and sandstone than Cabba soils. They are not so deep as Shambo soils, and they contain more clay than Vebar soils.

AgA—Amor loam, 1 to 3 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are small areas of Shambo, Sen, and Vebar soils on uplands that make up about 25 percent of the mapping unit.

Runoff is medium. The hazard of erosion is slight. The main concerns of management are maintaining organic-matter content and fertility and conserving moisture.

Most areas of this soil are cultivated. The soil is well suited to all crops commonly grown in the county. Capability unit IIc–6; Silty range site.

AgB—Amor loam, 3 to 6 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Arnegard, Shambo, and Vebar soils on uplands.

Runoff is medium to rapid. Soil blowing and water erosion are slight hazards. The main concerns of management are maintaining organic-matter content and fertility, conserving moisture, and controlling erosion.

Most areas of this soil are cultivated. The soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; Silty range site.

AgC—Amor loam, 6 to 9 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are small areas of Cabba, Shambo, and Vebar soils on uplands.

Runoff is rapid. Soil blowing and water erosion are moderate hazards. The main concerns of management are controlling erosion and maintaining organic-matter content and fertility.

Most areas of this soil are cultivated. Some areas are in native range. Capability unit IIIe–6; Silty range site.

Arnegard Series

The Arnegard series consists of deep, well drained, medium textured, gently sloping soils in slightly concave swales and on fans and foot slopes. These soils formed in medium textured materials that washed from adjacent slopes.

In a representative profile the surface layer is dark grayish brown loam about 16 inches thick. The subsoil is about 24 inches thick. The upper part is grayish brown loam about 15 inches thick. The lower part is light brownish gray loam about 9 inches thick. The underlying material is light brownish gray calcareous loam about 7 inches thick and, below that, light brownish gray, calcareous stratified fine sandy loam and loamy fine sand.

Permeability is moderate, and the available water capacity is high. Organic-matter content and fertility are high.

These soils are well suited to the crops, grasses, and trees grown in the county; most areas are cultivated.

Representative profile of Arnegard loam, 3 to 6 percent slopes, in tame grass 530 feet east and 225 feet north of the southwest corner of the southeast quarter of sec. 30, T. 135 N., R. 100 W.

A11—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

A12—5 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2)

moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; neutral; gradual wavy boundary.

B21—16 to 31 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; neutral; gradual wavy boundary.

B22—31 to 40 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

C1ca—40 to 47 inches; light brownish gray (2.5Y 6/2) loam, olive brown (2.5Y 4/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; lime segregated in medium sized soft masses; strong effervescence; neutral; clear wavy boundary.

C2—47 to 60 inches; light brownish gray (2.5Y 6/2) stratified fine sandy loam and loamy fine sand, grayish brown (2.5Y 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; fine soft masses of segregated lime; strong effervescence; mildly alkaline.

The B horizon is loam, silt loam, or silty clay loam. The B2 horizon has weak or moderate prismatic or subangular blocky structure.

Arnegard soils are near Farland, Grassna, Reeder, Shambo, and Vebar soils. Arnegard soils are deeper than Reeder and Vebar soils. Unlike Shambo soils, they lack a IIC horizon. Arnegard soils lack a B2t horizon, unlike Farland soils; and they contain more sand and less silt than Grassna soils.

ArB—Arnegard loam, 3 to 6 percent slopes. This soil is in concave swales and drainageways and on foot slopes in uplands.

Included with this soil in mapping are small areas of Grassna, Shambo, Parshall, and Amor soils in similar positions on the landscape.

Runoff is medium. Water erosion is a slight hazard. The main concerns of management are controlling erosion, maintaining fertility, and conserving moisture.

Nearly all areas of this soil are cultivated. This soil is well suited to all crops commonly grown in the county. Capability unit IIe–6; Silty range site.

Badland

BaF—Badland-Cabbart complex, 9 to 50 percent slopes. This complex consists of uplands that are undergoing rapid geologic erosion. It is characterized by outcrops of soft shale and sandstone bedrock and mostly shallow soils that overlie soft bedrock. About 30 to 85 percent of the surface is barren or sparsely vegetated.

This complex is about 50 percent Badland and 15 percent Cabbart soils. The Badland consists of cone-shaped knobs, buttes, escarpments, and walls that are partly stabilized by vegetation, and vegetated basins where gullies have cut at close intervals through nearly level to strongly sloping soils (fig. 2).

Included in mapping with this complex are Fleak and Brandenburg soils in uneroded upland areas; Patent, Glendive, Benz, and Sham soils on fans, foot slopes, and terraces; and Wabek soils on ridges.

Areas of this complex have some value for grazing, but the areas in grass are small and scattered. Some soils in steeper positions are not accessible to grazing animals. This complex is mainly used for range and as wildlife habitat, but areas in swales are used for hay. The terrain provides protection from blizzards for grazing animals and provides habitat for deer, antelope, and upland birds.

The main concern of management is regulating grazing to help control erosion. Capability unit VIIs (shallow); Badland part not assigned to a range site, Cabbart part in Shallow range site.

Bb—Badland. This is a miscellaneous area that consists of uplands. More than 85 percent of the acreage is undergoing geologic erosion. The areas are more than 40 acres in size. Badland consists mainly of knobs, buttes, escarpments, walls, gullied areas, and eroded valley floors. A few areas of shallow and moderately deep soils are on hillsides and hilltops. Slopes are commonly 50 percent or more.

Less than 15 percent of this mapping unit is vegetated. The vegetation is mainly on smooth, round hills and on mesas; in valleys and swales; and on side slopes below steeper positions.

Badland has little value for grazing because the grassy areas are very small and scattered (fig. 3). Most of the steeper positions are not accessible to grazing animals. Badland has some value, however, as wildlife habitat and rangeland.

The main concern of management is regulating grazing to help control erosion. Capability unit VIIIe–1; not assigned to a range site.

Belfield Series

The Belfield series consists of deep, well drained, nearly level to moderately sloping soils. These soils are medium textured and moderately fine textured. They formed in alluvium on terraces and uplands and in swales.

In a representative profile the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is light brownish gray silty clay loam about 4 inches thick. The subsoil is about 13 inches thick. The upper part is grayish brown silty clay about 4 inches thick; the lower part is light olive brown silt clay loam about 9 inches thick. The underlying material is calcareous silty clay loam. It is light brownish gray and white in the upper part and light yellowish brown in the lower part.

Permeability is moderately slow, and the available water capacity is moderate. Organic-matter content is moderate. Fertility is medium.

These soils are suited to small grain and grass. Most areas are in crops.

Representative profile of Belfield silt loam, 1 to 3 percent slopes, in cropland, 550 feet west and 230 feet

Figure 2.—This landscape of grassed slopes and wooded draws is characteristic of areas of Badland-Cabbart complex, 9 to 50 percent slopes. The value for grazing is limited, but the rough terrain provides habitat for wildlife and winter protection for livestock.

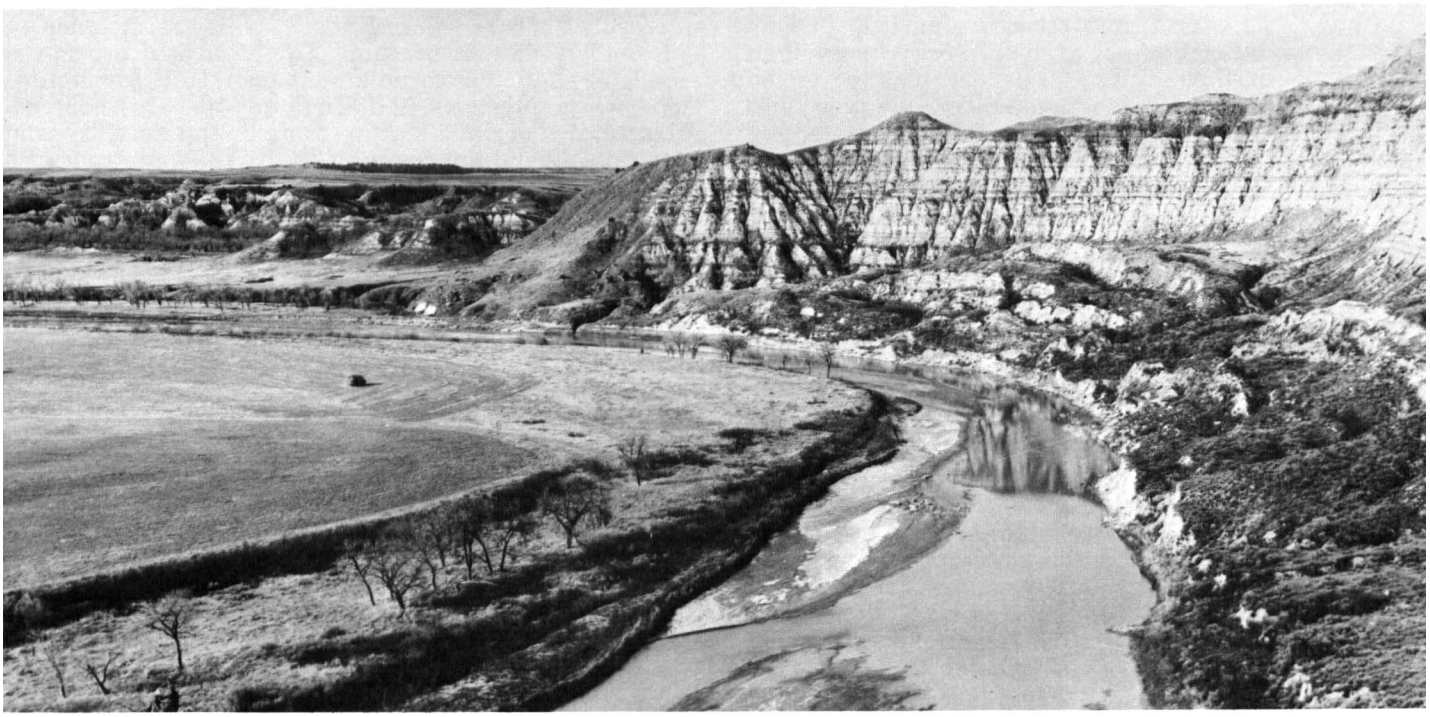

Figure 3.—Much of this area of Badland along Little Missouri River is inaccessible to grazing animals. Glendive and Hanly soils are on the low terraces.

south of the northeastern corner of sec. 4, T. 136 N., R. 98 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, very friable, sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A&B—8 to 12 inches; light brownish gray (2.5Y 6/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak thick platy parting to strong very fine subangular blocky; very hard, friable, sticky and plastic; uncoated sand grains on ped faces; slightly acid; clear smooth boundary.

B21t—12 to 16 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; strong medium prismatic structure parting to strong medium and fine angular blocky; extremely hard, friable, sticky and very plastic; uncoated sand grains on ped faces; thin continuous clay films on peds; neutral; clear wavy boundary.

B22t—16 to 25 inches; light olive brown (2.5Y 5/3) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable, sticky and very plastic; mildly alkaline; thin clay films on peds; clear wavy boundary.

C1ca—25 to 34 inches; light brownish gray and white (2.5Y 6/2 and 8/2) silty clay loam, dark grayish brown and light brownish gray (2.5Y 4/2 and 6/2) moist; weak fine prismatic structure parting to weak very fine subangular blocky; very hard, friable, sticky and very plastic; violent effervescence; moderately alkaline; lime segregated in rounded medium-sized soft masses; clear wavy boundary.

C2—34 to 60 inches; light yellowish brown (2.5Y 6/3) silty clay loam, olive brown (2.5Y 4/3) moist; massive; very hard, friable, sticky and very plastic; violent effervescence; moderately alkaline; disseminated lime.

The A horizon is grayish brown or dark grayish brown loam, silt loam, or silty clay loam. In some profiles there is a thin A2 horizon. The B2 horizon is dark gray, grayish brown, light olive brown, or dark grayish brown.

Belfield soils are on landscapes similar to those of Farland, Daglum, and Rhoades soils. Belfield soils have a finer textured B21t horizon than Farland soils. Unlike Daglum and Rhoades soils, they do not have columnar structure in the B horizon.

BeA—Belfield silt loam, 1 to 3 percent slopes. This soil is on fans, terraces, and uplands. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Rhoades, Daglum, Farland, Grail, and Morton soils in similar positions on the landscape. A pitted microrelief occurs where Rhoades soils are included.

Runoff is slow to medium. Soil blowing and erosion are slight problems. A shallow root zone and poor tilth are limitations where Rhoades and Daglum soils are included. Maintaining tilth, organic-matter content, and fertility and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Some areas are used for native range. Capability unit IIIs–6P; Clayey range site.

BeB—Belfield silt loam, 3 to 6 percent slopes. This soil is on uplands, terraces, and fans and in swales. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are small areas of Rhoades, Daglum, Farland, Sen, and Morton soils on similar landscapes. Also included are a few areas of Belfield silt loam, 6 to 9 percent slopes. A pitted microrelief occurs where Rhoades soils are included.

Runoff is medium. Water erosion is a moderate hazard. A shallow root zone and poor tilth are limitations where Rhoades and Daglum soils are included. Controlling erosion, maintaining organic-matter content and fertility, and maintaining and improving tilth are the main concerns of management.

Most areas of this soil are cultivated. Some are used for native range. Capability unit IIIe–6P; Clayey range site.

BfA—Belfield silty clay loam, 1 to 3 percent slopes. This soil is on terraces and uplands and in swales. It has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Savage and Grail soils on slightly concave parts of the landscape. Also included are small areas of Daglum and Rhoades soils on similar landscapes. A pitted microrelief occurs where Rhoades soils are included.

Runoff is slow to medium. The hazard of erosion is slight. A shallow root zone and poor tilth are limitations where Rhoades and Daglum soils are included. Maintaining organic-matter content and fertility and maintaining and improving tilth are the main concerns of management.

This soil is used for crops and native range. It is better suited to wheat, barley, and oats than to other cultivated crops. Capability unit IIIs–7P; Clayey range site.

BfB—Belfield silty clay loam, 3 to 6 percent slopes. This soil is on fans, terraces, and uplands. It has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Absher, Daglum, Grail, Regent, Rhoades, and Savage soils on similar landscapes. Also included are a few areas where the slopes are 6 to 9 percent. A pitted microrelief occurs where Rhoades soils are included.

Runoff is medium. Soil blowing and water erosion are slight hazards. Shallow rooting depth and poor tilth are limitations where Daglum and Rhoades soils are included. Controlling erosion and maintaining tilth, organic-matter content, and fertility are the main concerns of management.

Most areas of this soil are cultivated. This soil is

suited to most crops grown in the county. Some areas are in native range. Capability unit IIIe–7P; Clayey range site.

BhA—Belfield-Rhoades silty clay loams, 1 to 3 percent slopes. This complex is on valley floors and terraces. The surface has a scab appearance. Belfield soil is on the higher part of the landscape, and Rhoades soil occurs as dispersed spots or patches. These soils have a profile similar to the one described as representative of their series, but their surface layer is silty clay loam.

This complex is about 65 percent Belfield silty clay loam and 30 percent Rhoades silty clay loam. Small areas of Lawther and Savage soils on alluvial fans and terraces make up the rest.

Surface runoff is slow. The hazard of erosion is slight. Maintaining tilth is the main concern of management. Yields are lower on Rhoades soil than on Belfield soil because of salts and poor structure in the Rhoades subsoil.

In the eastern part of the county, most of this complex is cultivated. In the western part of the county, much of it is in native range or pasture. Capability unit IIIs–7P; Belfield part in Clayey range site, Rhoades part in Thin Claypan range site.

BhB—Belfield-Rhoades silty clay loams, 3 to 6 percent slopes. This complex is on valley sides and in swales at the upper end of drainageways. The surface has a scab appearance. Belfield soil is on the higher part of the landscape, and Rhoades soil occurs as dispersed spots or patches. These soils have a profile similar to the one described as representative of their series, but they have a surface layer of silty clay loam.

This complex is about 60 percent Belfield silty clay loam and 30 percent Rhoades silty clay loam. The rest is mostly Moreau silty clay on uplands and small areas that have slopes of 6 to 9 percent.

Runoff is medium. Water erosion is a moderate hazard, especially on the Rhoades soil. Low available water capacity, salts, and poor structure in the Rhoades subsoil are the main limitations. Maintaining tilth is the main concern of management.

In the eastern part of the county, most areas of this complex are cultivated. In the western part of the county, most of the areas are in native range or pasture. Capability unit IIIe–7P; Belfield part in Clayey range site, Rhoades part in Thin Claypan range site.

Benz Series

The Benz series consists of deep, well drained, nearly level to moderately sloping, medium textured and moderately fine textured soils on fans, foot slopes, and terraces. These soils formed in alluvium.

In a representative profile the surface layer is light brownish gray silt loam about 3 inches thick. The upper part of the underlying material is light brownish gray silt loam about 6 inches thick. Below this, the underlying material is light brownish gray and light gray calcareous stratified loam and silt loam about 11 inches thick, light brownish gray and light gray silt loam about 27 inches thick, and below this, grayish brown silt loam.

Permeability is slow and very slow, and the available water capacity is moderate. Organic-matter content and fertility are low.

These soils are used mainly for grazing. They are not well suited to cultivated crops.

Representative profile of Benz silt loam, 1 to 9 percent slopes, in native range, 800 feet west and 2,000 feet north of the southeastern corner of sec. 15, T. 134 N., R. 106 W.

A1—0 to 3 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate thin platy structure; hard, friable, slightly sticky and slightly plastic; hard crust in upper part; strongly alkaline; abrupt smooth boundary.

C1—3 to 9 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse and medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; strongly alkaline; clear wavy boundary.

C2ca—9 to 12 inches; light brownish gray and light gray (2.5Y 6/2 and 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure parting to weak thick platy; very hard, friable, slightly sticky and slightly plastic; strong effervescence; strongly alkaline; diffuse irregular boundary.

C3ca—12 to 20 inches; light brownish gray and light gray (2.5Y 6/2 and 7/2) stratified loam and silt loam, grayish brown (2.5Y 5/2) moist; moderate thick platy structure; very hard, friable, slightly sticky and nonplastic; strong effervescence; very strongly alkaline; diffuse irregular boundary.

C4—20 to 47 inches; light brownish gray and light gray (2.5Y 6/2 and 7/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak thick platy structure; hard, friable, slightly sticky and nonplastic; slight effervescence; strongly alkaline; diffuse irregular boundary.

C5—47 to 60 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, sticky and slightly plastic; strongly alkaline.

The A horizon is silt loam or clay loam. It has subangular blocky or platy structure.

Benz soils are near Absher, Patent, and Glendive soils. Unlike Absher soils, Benz soils do not have columnar structure. They contain more silt and clay than Glendive soils, and they are more alkaline than Patent soils.

BkC—Benz silt loam, 1 to 9 percent slopes. This soil is on fans, terraces, and foot slopes. It has the profile described as representative of the series.

Included with this soil in mapping are Absher, Sham, and Patent soils in similar positions on the landscape. The surface layer of the Absher soils is dispersed and pitted.

Runoff is rapid. Water erosion is a slight hazard. Some areas have a few narrow, shallow gullies. Salinity

is the main limitation. Proper range use is the main concern of management.

Most areas of this soil are in native range. Capability unit VIs (Thin Claypan); Thin Claypan range site.

BnC—Benz and Absher clay loams, 1 to 9 percent slopes. This is an undifferentiated group on fans and terraces and in swales. Some mapped areas consist almost entirely of the Benz soil; others consist almost entirely of the Absher soil. The Benz and Absher soils have a profile similar to the one described as representative of their respective series, but the surface layer is clay loam.

Included with these soils in mapping, in similar positions on the landscape, are Patent and Sham soils that make up as much as 20 percent of some mapped areas.

Runoff is rapid. Salinity is the main limitation. The main concern of management is proper range use. This soil has fair vegetative cover.

Most areas of this mapping unit are in native range. Capability unit VIs (Thin Claypan); Thin Claypan range site.

Borolls, Saline

Bo—Borolls, saline. These soils are at the base of slopes and on side slopes in uplands. Areas are mostly small and irregular. Slopes are 1 to 6 percent. The water table is at or near the surface most of the year.

In most years, these soils are not suited to vegetation because of high salinity. Capability unit VIs (Saline Lowland); Saline Lowland range site.

Borolls and Orthents, Stony

BrE—Borolls and Orthents, stony, 15 to 45 percent slopes. This mapping unit consists of shallow soils directly below the steep, uppermost escarpments of buttes (fig. 4). Some areas consist of only one of the soils. About 20 percent of the surface area is covered by rocks. Most of the rocks are siliceous, and they generally are 1 foot to 4 feet in diameter.

Included with these soils in mapping are areas of Cabba and Flasher soils. Runoff is very rapid. Proper range use is the main concern of management.

These soils are used as rangeland for livestock and wildlife. Capability unit VIIs (Shallow); Shallow range site.

Boxwell Series

The Boxwell series consists of moderately deep, well drained, gently sloping to moderately sloping, medium textured soils on uplands. These soils formed in weathered loam shale or soft sandstone.

In a representative profile the surface layer is grayish brown loam about 6 inches thick. The subsoil is loam about 20 inches thick. It is grayish brown in the upper 3 inches, brown in the next 6 inches, and light brownish gray and calcareous in the lower 11 inches. The underlying material is light gray calcareous silt loam about 11 inches thick and, below that, light gray soft shale.

Permeability and the available water capacity are moderate. Organic-matter content is moderate, and fertility is medium.

Figure 4.—**This area of Borolls and Orthents, stony, 15 to 45 percent slopes, is well suited to native rangeland but is too stony for cultivated uses.**

These soils are used for crops. Some areas are in native grass. These soils are suited to the cultivated crops commonly grown in the county.

Representative profile of Boxwell loam, 6 to 9 percent slopes, in a cultivated field 1,510 feet south and 570 feet east of the northwestern corner of sec. 7, T. 135 N., R. 106 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; hard, friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

B21—6 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, nonsticky and nonplastic; neutral; clear smooth boundary.

B22—9 to 15 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate coarse and medium prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B3ca—15 to 26 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak coarse and medium prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; gradual smooth boundary.

C1ca—26 to 37 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few masses of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C2—37 to 60 inches; light gray (2.5Y 7/2) soft shale; slight effervescence; moderately alkaline.

The B2 horizon is grayish brown, brown, or light brownish gray loam or silt loam. The depth to soft shale or soft, fine grained sandstone is 20 to 40 inches.

Boxwell soils are on a landscape similar to that of Rhame, Kremlin, and Cabbart soils. Boxwell soils contain more clay than Rhame soils. They are not so deep as Kremlin soils, and they are deeper than Cabbart soils.

BtB—Boxwell loam, 3 to 6 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are small areas of Rhame and Cabbart soils on uplands, Kremlin soils on fans and terraces, and a few areas of Boxwell loam, 1 to 3 percent slopes.

Runoff is medium. Water erosion is a moderate hazard. Controlling erosion and maintaining fertility and organic-matter content are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6; Silty range site.

BtC—Boxwell loam, 6 to 9 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are Cabbart and Rhame soils on uplands and Kremlin soils on fans and terraces.

Runoff is medium. Water erosion is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

This soil is used for crops and native range. Capability unit IVe–6; Silty range site.

Brandenburg Series

The Brandenburg series consists of shallow, excessively drained, medium textured, moderately sloping to very steep soils on uplands. These soils formed in porcellanite beds.

In a representative profile the surface layer is brown channery loam about 10 inches thick. The underlying material is porcellanite beds.

Permeability is moderate to rapid, and the available water capacity is very low. Organic-matter content and fertility are low.

Most areas of these soils are in native grass. Some small areas are cultivated.

Representative profile of Brandenburg channery loam, in an area of Brandenburg-Cabba complex, 6 to 40 percent slopes, 580 feet east and 90 feet south of the northwestern corner of sec. 18, T. 133 N., R. 101 W.

A1—0 to 10 inches; brown (7.5YR 5/3) channery loam, dark brown (7.5YR 4/2) moist; weak fine crumb structure; soft, friable, nonsticky and nonplastic; about 20 percent porcellanite chips; slight effervescence; neutral; gradual wavy boundary.

R—10 to 30 inches; light brown (7.5YR 6/3) porcellanite beds, pink (7.5YR 8/4) moist; shattered beds partially filled with loamy material in the upper part, cleavage cracks below; very slight effervescence in the upper part.

The depth to hard porcellanite beds is 10 to 20 inches.

Brandenburg soils are near Ringling and Searing soils. They have a thicker A1 horizon than Ringling soils, and they are not so deep as Searing soils.

BuE—Brandenburg-Cabba complex, 6 to 40 percent slopes. The soils making up this complex are moderately sloping to very steep. They are on uplands in areas characterized by knobs, cone-shaped hills, and ridges that have many clinkers and porcellanite outcrops. Brandenburg soils have the profile described as representative of the series.

This complex is about 55 percent Brandenburg channery loam and 40 percent Cabba loam. The rest is Searing soils on side slopes.

Runoff is slow to very rapid. Water erosion is a severe hazard. Proper range use is the main concern of management.

Most areas of these soils are in native range. Some areas are cultivated. These are mainly small tracts in fields that consist mainly of soils that are suited to cul-

tivation. Capability unit VIIs (Very Shallow); Brandenburg part in Very Shallow range site, Cabba part in Shallow range site.

Cabba Series

The Cabba series consists of shallow, excessively drained, medium textured, gently sloping to very steep soils on uplands. These soils formed in weathered soft shale, siltstone, and fine grained sandstone.

In a representative profile the surface layer is grayish brown calcareous loam about 4 inches thick. The layer below that is light gray calcareous loam about 5 inches thick, and the next layer is light gray calcareous silt loam about 8 inches thick. White soft sedimentary beds are at a depth of about 17 inches.

Permeability is moderate, and the available water capacity is low. Organic-matter content and fertility are low.

These soils are mostly in native grass. In some areas they are cultivated with the adjacent soils.

Representative profile of Cabba loam, 15 to 40 percent slopes, in native grass 2,000 feet north and 130 feet east of the southwestern corner of sec. 36, T. 133 N., R. 102 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; slightly effervescent; mildly alkaline; clear wavy boundary.

C1ca—4 to 9 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable, nonsticky and nonplastic; strongly effervescent; moderately alkaline; clear wavy boundary.

C2ca—9 to 17 inches; light gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; soft, very friable, slightly sticky and nonplastic; strongly effervescent; moderately alkaline; gradual boundary.

C3—17 to 50 inches; white (2.5Y 8/2) soft sedimentary beds, light grayish brown (2.5Y 6/2) moist, that crush to very fine sandy loam; some thin strata of silt loam; mildly effervescent; moderately alkaline.

The A horizon is grayish brown or light brownish gray loam or silt loam. The depth to paralithic beds is 10 to 20 inches.

Cabba soils are on a landscape similar to that of Chama, Flasher, Sen, and Wayden soils. They are not so deep as Chama and Sen soils. Cabba soils contain less clay than Wayden soils and more clay than Flasher soils.

CaE—Cabba loam, 15 to 40 percent slopes. This soil is on uplands (fig. 5). It has the profile described as representative of the series.

Included with this soil in mapping are Chama, Flasher, and Wayden soils on uplands, Patent soils in swales, and Korchea soils along narrow drainageways and in stream valleys. Also included are a few small areas of Badland.

Runoff is very rapid. Erosion is a severe hazard.

Figure 5.—**Cabba loam, 15 to 40 percent slopes, is on the uplands, and Patent soils are in the swales. These soils need a good grass cover to protect them from erosion.**

The soils needs range management that maintains a good grass cover.

Most areas of this soil are in native range. Capability unit VIIe (Shallow); Shallow range site.

CbE—Cabba-Badland complex, 9 to 40 percent slopes. This complex is moderately steep to very steep on uplands. Cabba soils have a profile similar to the one described as representative of the series, but the surface layer is thinner. Badland is barren or nearly barren land areas of rock outcrop. The barren areas are undergoing geologic erosion.

The complex is about 65 percent Cabba soils and 20 percent Badland. The rest is Patent soils on fans and foot slopes, Flasher and Wayden soils on uplands, and soils in narrow, eroding drainageways between the uplands.

Runoff is very rapid. Water erosion is a severe hazard. The main concern of management is proper use that maintains a good grass cover.

The soils in this complex are in native range. Capability unit VIIe (Shallow); Cabba part in Shallow range site, Badland part not placed in a range site.

CcD—Cabba-Chama complex, 9 to 15 percent slopes. This complex is on uplands. The soils have a profile similar to that described as representative of their series, but Cabba soils have a thicker surface layer and Chama soils have a thinner surface layer.

This complex is about 70 percent Cabba soils and 25 percent Chama soils. The rest consists of Cabba soils and a soil similar to Chama soils that have a surface layer that ranges from loam to silty clay loam, some areas of Sen soils on side slopes, and areas of Cabba and Chama soils that have slopes of 15 to 25 percent.

Runoff is rapid. Water erosion and soil blowing are severe hazards. Proper range use to maintain a good grass cover is the main concern of management.

Most areas of these soils are in native range. Capability unit VIe (Shallow); Cabba part in Shallow range site, Chama part in Silty range site.

CdD—Cabba-Chama stony loams, 3 to 20 percent slopes. This complex is on uplands. About 15 to 20 percent of the surface is covered by stones. The soils have a profile similar to that described as representative of their series, but the surface layer is thicker.

This complex is about 50 percent Cabba soils and 40 percent Chama soils. The rest is Morton stony loam on uplands and some areas where the slopes exceed 20 percent.

Runoff is medium to rapid. The surface is too stony for the use of machinery. Proper range use is the only concern of management.

These soils are in native range. Capability unit VIIs (Shallow); Cabba part in Shallow range site, Chama part in Silty range site.

Cabbart Series

The Cabbart series consists of shallow, well drained to excessively drained, gently sloping to very steep, medium textured soils on uplands. These soils formed in weathered soft shale, siltstone, and fine grained sandstone.

In a representative profile the surface layer is light olive brown calcareous silt loam about 2 inches thick. The underlying material is light yellowish brown calcareous silt loam about 8 inches thick and, below that, soft sedimentary beds.

Permeability is moderate, and the available water capacity is low. Organic-matter content and fertility are low.

Most of these soils are in native grass. A few areas are cultivated. These soils are best suited to grasses.

Representative profile of Cabbart silt loam, 9 to 15 percent slopes, in native grass 2,070 feet east and 170 feet north of the southwestern corner of sec. 28, T. 134 N., R. 105 W.

A1—0 to 2 inches; light olive brown (2.5Y 5/3) silt loam, dark grayish brown (2.5Y 4/2) moist; weak fine granular structure; soft, friable, slightly sticky and nonplastic; violent effervescence; mildly alkaline; abrupt smooth boundary.

C1ca—2 to 10 inches; light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and nonplastic; about 5 percent soft siltstone fragments; violent effervescence; mildly alkaline; clear wavy boundary.

C2ca—10 to 12 inches; pale yellow (2.5Y 7/4) soft siltstone that crushes to silt loam, light olive brown (2.5Y 5/4) moist; moderate thick platy structure; soft, friable, slightly sticky and nonplastic; lime segregated in rounded medium sized soft masses; violent effervescence; mildly alkaline; clear wavy boundary.

C3—12 to 40 inches; light yellowish brown (2.5Y 6/4) soft siltstone that crushes to silt loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; common ironstone concretions; few gypsum crystals; slight effervescence; moderately alkaline.

The A horizon is light olive brown, light grayish brown, or grayish brown. The depth to stratified soft beds is 10 to 20 inches.

Cabbart soils are near Boxwell soils. They are not so deep as Boxwell soils.

CfC—Cabbart silt loam, 3 to 9 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are Chama, Fleak, and Wayden soils on uplands and a few small areas of rock outcrop that are designated on the maps by a special symbol.

Runoff is medium. Water erosion is a moderate to severe hazard, and soil blowing is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Some are used for native range. Capability unit IVe–4L; Shallow range site.

CfD—Cabbart silt loam, 9 to 15 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are Patent, Chama, Fleak, Glendive, Havre, Absher, Sen, Boxwell,

and Benz soils. Chama, Fleak, Boxwell, and Sen soils are on uplands; Patent, Glendive, Havre, Absher, and Benz soils are on fans, foot slopes, and terraces. Also included are small barren, eroded areas and outcrops of rock which make up as much as 10 percent of the mapping unit in some places.

Runoff is rapid. Water erosion is a severe hazard. Proper range use that maintains a good grass cover is the main concern of management.

Almost all areas of this soil are used for native range. Capability unit VIIe (Shallow) ; Shallow range site.

CfE—Cabbart silt loam, 15 to 40 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Patent, Chama, Fleak, Wayden, Glendive, Havre, Absher, Benz, Boxwell, Sen, and Rhame soils. Chama, Fleak, Wayden, Boxwell, Sen, and Rhame soils are on uplands; Glendive, Havre, Absher, and Benz soils are on fans, foot slopes, and terraces. Also included are areas of rock outcrop, barren areas, and areas that are undergoing geologic erosion (fig. 6).

Runoff is rapid. Water erosion is a serious hazard. The soils need range management that maintains a good grass cover.

Almost all areas of this soil are in native range. Capability unit VIIe (Shallow) ; Shallow range site.

CgE—Cabbart-Badland complex, 9 to 40 percent slopes. This complex is on uplands that are undergoing limited geologic erosion (fig. 7). The Badland consists of eroded areas that are barren or nearly barren.

This complex consists of about 45 percent Cabbart soils and 25 percent Badland. The rest is large areas of Patent, Fleak, Glendive, Benz, Absher, Brandenburg, and Wabek soils. Brandenburg and Fleak soils are on uplands; Glendive, Benz, and Absher soils are on fans, foot slopes, and terraces; and Wabek soils are on ridges on outwash plains and terraces.

Runoff is rapid. Erosion is a severe hazard. Because of steep slopes and rough terrain, the areas are not easily accessible to grazing animals. Grazing must be carefully managed to maintain a grass cover.

The soils in this complex are used for native range. Capability unit VIIe (Shallow) ; Cabbart part in Shallow range site, Badland part not assigned to a range site.

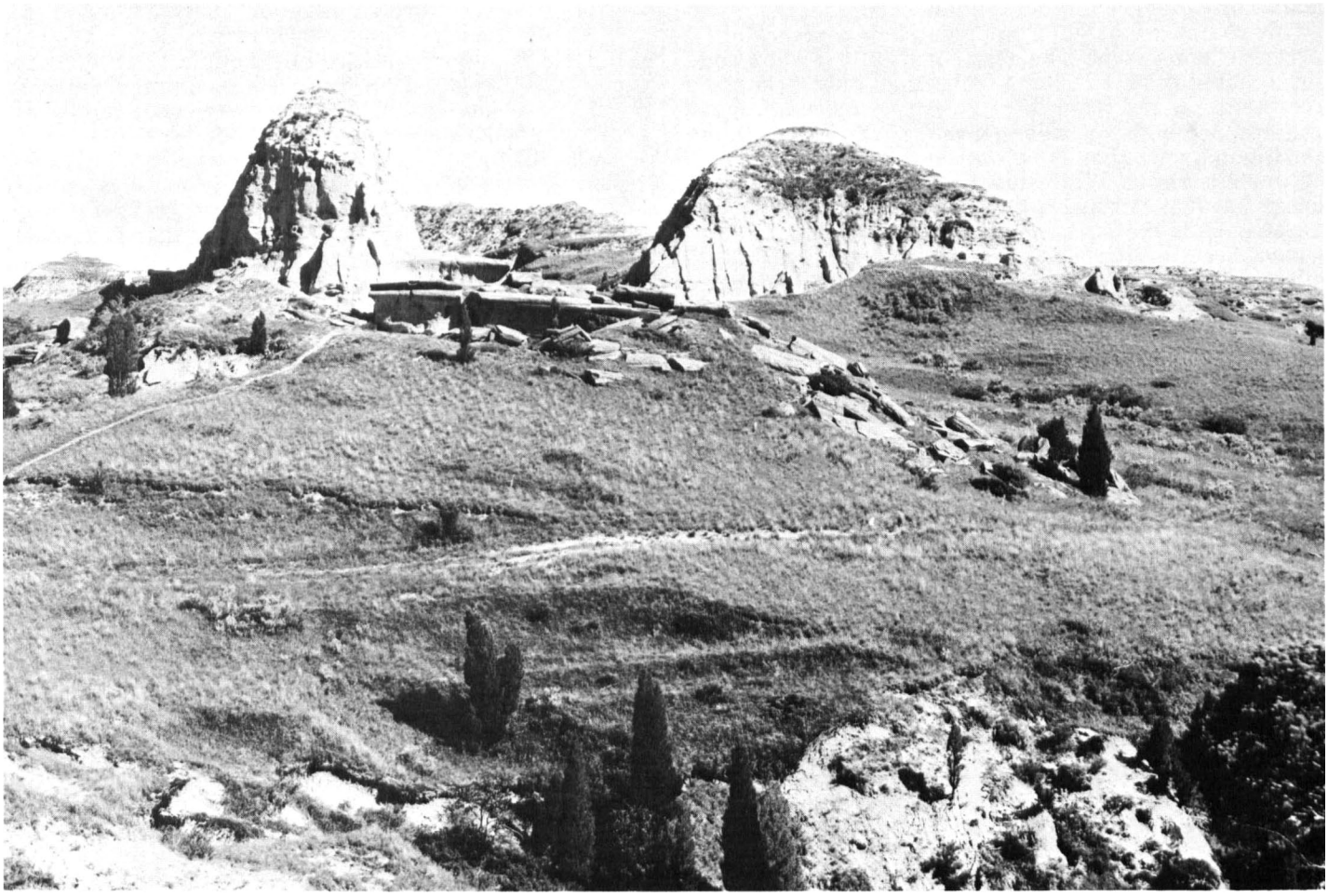

Figure 6.—Cabbart silt loam, 15 to 40 percent slopes, is mostly in native rangeland but includes some barren areas and outcrops of rock.

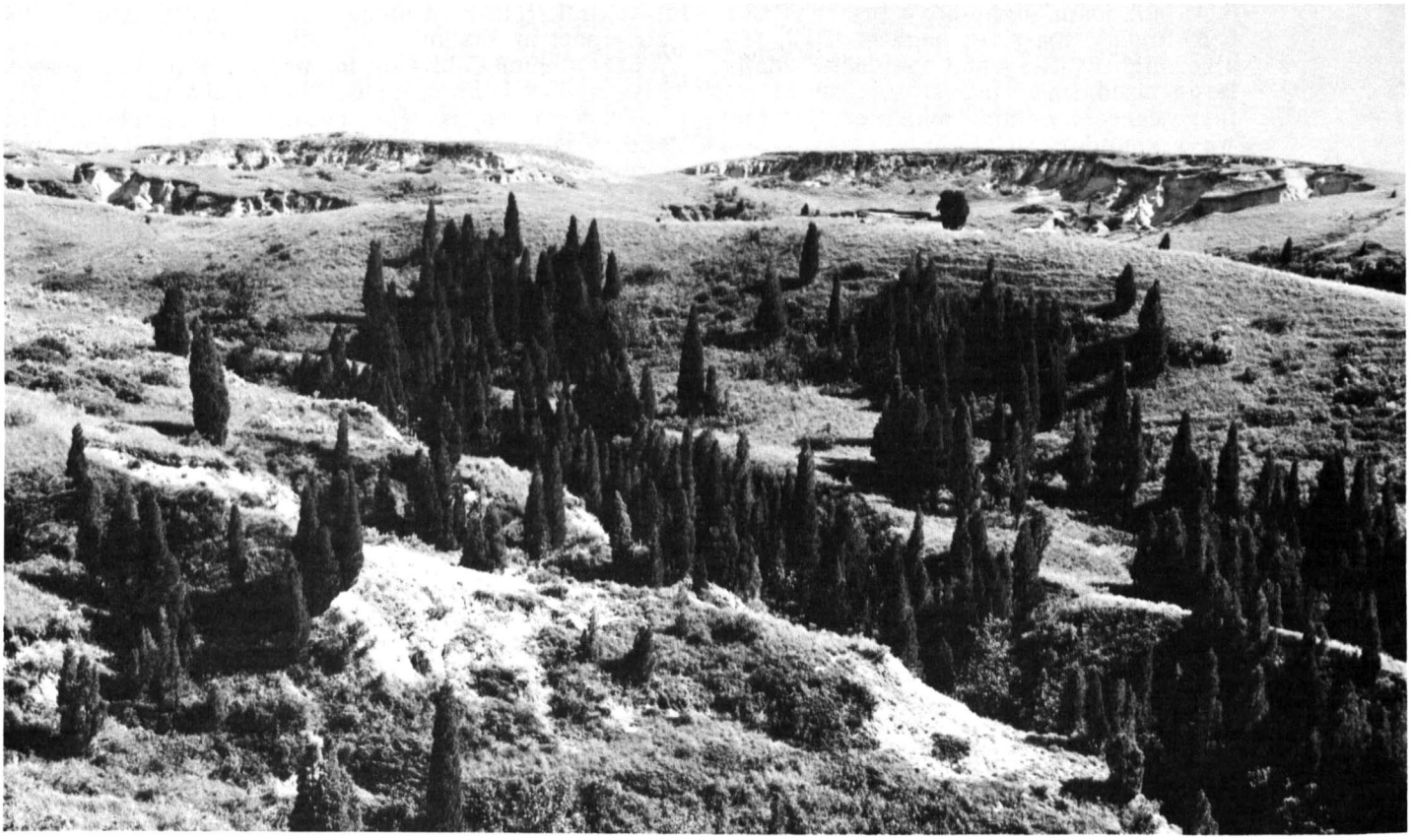

Figure 7.—**This area of Cabbart-Badland complex, 9 to 40 percent slopes, is in native rangeland. The columnar junipers are in an area called the Burning Coal Vein.**

Chama Series

The Chama series consists of moderately deep, well drained, nearly level to strongly sloping, medium textured soils on uplands. These soils formed in material weathered from shale, siltstone, and fine grained sandstone.

In a representative profile the surface layer is grayish brown silt loam about 4 inches thick. The subsoil is silt loam about 9 inches thick. It is grayish brown in the upper part and light gray and calcareous in the lower part. The underlying material is light yellowish brown calcareous silt loam about 21 inches thick and, below that, soft sedimentary beds.

Permeability is moderately slow, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used mainly for crops. Some areas are in native grass. These soils are suited to all cultivated crops commonly grown in the county.

Representative profile of Chama silt loam, in an area of Chama-Cabba silt loams, 6 to 9 percent slopes, in tame grass 1,180 feet north and 1,420 feet east of the southwestern corner of sec. 15, T. 136 N., R. 99 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; abrupt smooth boundary.

B2—4 to 8 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; slight effervescence; neutral; clear smooth boundary.

B3ca—8 to 13 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, friable, slightly sticky and nonplastic; many small sized soft lime masses; violent effervescence; neutral; clear smooth boundary.

C1ca—13 to 22 inches; light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; weak medium subangular blocky structure parting to weak thick platy; slightly hard, friable, slightly sticky and nonplastic; many medium sized lime masses; violent effervescence; mildly alkaline; clear smooth boundary.

C2—22 to 34 inches; light yellowish brown (2.5Y

6/4) silt loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable, slightly sticky and nonplastic; many large sized lime concretions; slight effervescence; mildly alkaline; gradual wavy boundary.

C3—34 to 50 inches; pale yellow (2.5Y 7/4) soft siltstone that crushes to loam, light olive brown (2.5Y 5/4) moist; slight effervescence; mildly alkaline.

The A horizon is grayish brown or brown. The B horizon is loam or silt loam and has weak to moderate prismatic structure. The depth to sedimentary beds is 40 to 60 inches.

Chama soils are on a landscape similar to that of Cabba, Flasher, Morton, Sen, and Vebar soils. Chama soils are deeper than Flasher and Cabba soils. Unlike Morton soils, Chama soils lack a Bt horizon. They have lime at a shallower depth than Sen and Vebar soils.

CmA—Chama silt loam, 1 to 3 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are soils that are similar to this Chama soil but that have a silty clay loam surface layer, a few areas of Sen and Amor soils on uplands, and Chama soils that are moderately eroded.

Runoff is medium. Soil blowing and water erosion are slight hazards. The main concern of management is conserving moisture and maintaining fertility.

Almost all areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

CmB—Chama silt loam, 3 to 6 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are soils that are similar to this Chama soil but have a silty clay loam surface layer. Also included are small areas of Cabba, Cabbart, and Sen soils on uplands and a few small areas of eroded Chama soils.

Runoff is medium. Soil blowing and water erosion are a slight to moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6; Silty range site.

CoB—Chama-Cabba silt loams, 3 to 6 percent slopes. This complex is on uplands. The soils in this complex have a profile similar to the one described as representative of their series, but the Chama soils have a thicker surface layer and the Cabba soils have a silt loam surface layer.

This complex consists of about 70 percent Chama soils and 25 percent Cabba soils. The rest consists of soils that are similar to Chama soils and Cabba soils that have a silty clay loam surface layer, areas that are moderately eroded, and a few small areas of Sen and Amor soils on uplands.

Runoff is medium. Soil blowing and water erosion are moderate hazards. The main concerns of management are controlling erosion, conserving moisture, and maintaining fertility.

Almost all areas of these soils are cultivated. Capability unit IIIe–6; Chama part in Silty range site, Cabba part in Shallow range site.

CoC—Chama-Cabba silt loams, 6 to 9 percent slopes. This complex is on uplands. The Chama soils have the profile described as representative of the series. The Cabba soils have a profile similar to the one described as representative of the series, but the surface layer is silt loam.

This complex consists of about 60 percent Chama soils and 35 percent Cabba soils. The rest consists of soils similar to Chama soils and Cabba soils that have a silty clay loam surface layer, areas that are moderately eroded, and small areas of Sen soils on uplands.

Runoff is medium. Soil blowing and water erosion are moderate hazards. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Almost all areas of these soils are cultivated. Capability unit IIIe–6; Chama part in Silty range site, Cabba part in Shallow range site.

CoD—Chama-Cabba silt loams, 9 to 15 percent slopes. This complex is on uplands. The soils in this complex have a profile similar to the one described as representative of their series, but the Chama soils have a thinner surface layer and the Cabba soils have a silt loam surface layer.

This complex consists of about 40 percent Chama soils and 40 percent Cabba soils. The rest consists of soils similar to Chama soils and Cabba soils that have a silty clay loam surface layer, areas that are moderately eroded, and Amor, Reeder, Wayden, Sen, and Flasher soils on uplands.

Runoff is medium. Soil blowing and water erosion are moderate hazards. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are in grass or native range. Some areas are cultivated. Capability unit IVe–6; Chama part in Silty range site, Cabba part in Shallow range site.

CrC—Chama-Cabbart silt loams, 6 to 9 percent slopes. This complex is on uplands. The Chama soils in this complex have a profile similar to the one described as representative of that series, but the surface layer is lighter colored.

This complex consists of about 50 percent Chama soils and 40 percent Cabbart soils. The rest is Sen and Boxwell soils on uplands and Golva and Absher soils on fans and terraces and in shallow swales.

Runoff is medium. Soil blowing and water erosion are moderate hazards. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

The soils in this complex are used for cultivated crops and native range. Capability unit IIIe–6; Chama part in Silty range site, Cabbart part in Shallow range site.

Chanta Series

The Chanta series consists of deep, well drained, nearly level to gently sloping soils on stream terraces and fans. These soils formed in medium textured alluvium.

In a representative profile the surface layer is grayish brown loam about 6 inches thick. The subsoil is

about 20 inches thick. The upper part is grayish brown loam about 5 inches thick, the middle part is brown loam about 10 inches thick, and the lower part is light brownish gray loam about 5 inches thick. The underlying material is light gray very gravelly loam and light brownish gray gravel and sand.

Permeability is moderate in the surface layer and subsoil and rapid in the gravel and sand. The available water capacity is low. Organic-matter content is moderate, and fertility is medium.

These soils are used mainly for crops and native grass. Nearly level Chanta soils are well suited to irrigation.

Representative profile of Chanta loam, 1 to 3 percent slopes, 544 feet south and 30 feet east of the center of sec. 2, T. 136 N., R. 104 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B21—6 to 11 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B22—11 to 21 inches; brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; thin clay films on ped faces; neutral; clear wavy boundary.

B3ca—21 to 26 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure; hard, friable, slightly sticky and slightly plastic; lime coatings on bottom of pebbles; few cobblestones; strong effervescence; mildly alkaline; clear wavy boundary.

IIC1ca—26 to 31 inches; light gray (2.5Y 7/2) very gravelly loam, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure; loose, very friable, nonsticky and nonplastic; lime coatings on bottom of pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2—31 to 60 inches; light brownish gray (2.5Y 6/2) gravel and sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, nonsticky and nonplastic; strong effervescence; mildly alkaline.

The A horizon is grayish brown or dark grayish brown. The B2 horizon has moderate to strong prismatic structure. The depth to sand and gravel is 20 to 40 inches.

Chanta soils are on a landscape similar to that of Chinook, Hanly, Havre, Kremlin, Rhame, and Wabek soils. They are deeper than Rhame soils. Unlike Chinook, Hanly, Havre, and Kremlin soils, Chanta soils have a gravelly IIC horizon. Chanta soils are deeper to gravel than Wabek soils.

CtA—Chanta loam, 1 to 3 percent slopes. This soil is on fans and terraces. It has the profile described as representative of the series.

Included with this soil in mapping are Kremlin soils on fans and terraces and Wabek soils on ridges.

Runoff is slow. Soil blowing is a moderate hazard. Low available water capacity is the main limitation to the use of this soil. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are in grass. This soil is well suited to irrigation if a suitable water supply is available. Capability unit IIIs–6G; Silty range site.

CtB—Chanta loam, 3 to 6 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but it is shallower to gravel.

Included with this soil in mapping are Wabek soils on ridges and Kremlin soils and some small areas of Chinook soils on fans and terraces. Also included are Chanta soils that have slopes of 6 to 9 percent.

Runoff is medium. Soil blowing is a moderate hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–6G; Silty range site.

Cherry Series

The Cherry series consists of deep, well drained, gently sloping to moderately sloping, moderately fine textured soils on fans, foot slopes, and terraces. These soils formed in material that eroded from steeper areas.

In a representative profile the surface layer is grayish brown silty clay loam about 4 inches thick. The subsoil is about 17 inches thick. The upper part is grayish brown silty clay loam about 10 inches thick, and the lower part is light brownish gray silty clay loam about 7 inches thick. The underlying material is light olive gray calcareous silty clay loam about 21 inches thick; below that there is pale olive silty clay.

Permeability is moderate in the surface layer and subsoil and moderately slow in the underlying material. The available water capacity is high. Organic-matter content is moderate, and fertility is medium.

These soils are suited to crops commonly grown in the county. About half of the acreage is cultivated, and half is in native grass.

Representative profile of Cherry silty clay loam, 3 to 9 percent slopes, in native grass 800 feet west and 20 feet north of the southeastern corner of the northeast quarter of sec. 14, T. 134 N., R. 102 W.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure parting to moderate coarse and medium granular; hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

B21—4 to 14 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse and medium prismatic structure parting to moderate medium angular blocky; hard, firm, sticky

and plastic; moderately alkaline; clear smooth boundary.

B22—14 to 21 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate medium angular blocky; hard, firm, sticky and plastic; slight effervescence; moderately alkaline; gradual wavy boundary.

C1—21 to 29 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 4/2) moist; weak coarse prismatic structure parting to weak medium angular blocky; hard, firm, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—29 to 42 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 4/2) moist; massive; very hard, very firm, very sticky and plastic; slight effervescence; moderately alkaline; abrupt smooth boundary.

C3—42 to 60 inches; pale olive (5Y 6/3) silty clay, olive (5Y 5/3) moist; massive; very hard, very firm, very sticky and plastic; slight effervescence; moderately alkaline.

The A horizon is light brownish gray or grayish brown. The B2 horizon is light brownish gray, pale olive, grayish brown, or light olive brown clay loam or silty clay loam. Stratification is common in some profiles.

Cherry soils are near Patent soils. They contain more silt and less sand than Patent soils.

CyC—Cherry silty clay loam, 3 to 9 percent slopes. This soil is on fans, foot slopes, and terraces.

Included with this soil in mapping are Cherry soils that have a silt loam surface layer; some areas that have slopes of 1 to 3 percent; some areas of Patent soils on fans, foot slopes, and terraces; and Cabba, Cabbart, and Brandenburg soils on uplands.

Runoff is medium. Water erosion is a moderate hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–6; Silty range site.

Chinook Series

The Chinook series consists of deep, well drained, nearly level to moderately sloping, moderately coarse textured soils on fans, foot slopes, and terraces. These soils formed in residual and alluvial materials.

In a representative profile the surface layer is grayish brown fine sandy loam about 5 inches thick. The subsoil is grayish brown fine sandy loam about 6 inches thick. The underlying material is calcareous fine sandy loam that is light yellowish brown in the upper 6 inches and light gray in the next 22 inches and, below that, pale yellow loamy fine sand.

Permeability is moderate to moderately rapid, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used for crops and native grass. They are best suited to grass.

Representative profile of Chinook fine sandy loam, in an area of Rhame-Chinook fine sandy loams, 3 to 6 percent slopes, in native grass 190 feet east and 70 feet south of the northwestern corner of the southwest quarter of sec. 25, T. 136 N., R. 104 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear wavy boundary.

B2—5 to 11 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear wavy boundary.

C1ca—11 to 17 inches; light yellowish brown (2.5Y 6/4) fine sandy loam, olive brown (2.5Y 4/4) moist; weak coarse and medium subangular blocky structure parting to weak medium granular; soft, very friable, nonsticky and nonplastic; violent effervescence; mildly alkaline; gradual wavy boundary.

C2ca—17 to 39 inches; light gray (2.5Y 7/2) fine sandy loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure parting to weak medium granular; few masses of segregated lime; violent effervescence; mildly alkaline; clear smooth boundary.

C3—39 to 60 inches; pale yellow (2.5Y 7/4) loamy fine sand, light olive brown (2.5Y 5/4) moist; single grained; very soft, very friable, nonsticky and nonplastic; violent effervescence; moderately alkaline.

The A horizon is brown or grayish brown. The B2 horizon is grayish brown, light brownish gray, or light olive brown.

Chinook soils are on a landscape similar to that of Fleak, Rhame, Boxwell, and Kremlin soils. Chinook soils are deeper than Boxwell, Fleak, and Rhame soils, and they contain less clay than Kremlin soils.

CzB—Chinook fine sandy loam, 1 to 6 percent slopes. This soil is on fans, foot slopes, and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is about 3 inches thicker.

Included with this soil in mapping are Kremlin soils on fans, foot slopes, and terraces and Rhame soils on uplands.

Runoff is slow. Soil blowing is a moderate hazard. Controlling soil blowing and conserving moisture are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–3; Sandy range site.

Daglum Series

The Daglum series consists of deep, well drained and moderately well drained, nearly level to moderately sloping, moderately fine textured and moderately coarse textured soils on terraces, fans, foot slopes, and uplands

and in swales. These soils have a claypan subsoil. They formed in alluvium and soft shale.

In a representative profile the surface layer is grayish brown silty clay loam about 9 inches thick. The subsurface layer is grayish brown silty clay loam about 2 inches thick. The subsoil is grayish brown silty clay about 21 inches thick. The lower part is calcareous. The underlying material is grayish brown calcareous silty clay.

Permeability is slow, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used for crops and native grass. They are not suited to trees.

Representative profile of Daglum silty clay loam, in an area of Daglum-Rhoades silty clay loams, 1 to 6 percent slopes, in native grass 570 feet east and 230 feet south of the northwestern corner of sec. 28, T. 135 N., R. 100 W.

A11—0 to 5 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; slightly hard, firm, sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak thick platy; hard, firm, sticky and slightly plastic; slightly acid; clear smooth boundary.

A2—9 to 11 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine angular blocky structure; hard, firm, sticky and slightly plastic; slightly acid; abrupt smooth boundary.

B2t—11 to 23 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong coarse and medium columnar structure parting to strong medium angular blocky; very hard, firm, very sticky and very plastic; thin clay films on sides of columns; neutral; gradual smooth boundary.

B3ca—23 to 32 inches, grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong coarse and medium prismatic structure; extremely hard, firm, very sticky and very plastic; strong effervescence; moderately alkaline; lime segregated in soft masses; gradual smooth boundary.

C1ca—32 to 60 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; massive; extremely hard, firm, very sticky and plastic; lime segregated in soft masses; violent effervescence; mildly alkaline.

The A1 horizon is grayish brown or dark grayish brown silty clay loam or fine sandy loam. The A2 horizon is light brownish gray, light gray, or grayish brown loam or silty clay loam 1 to 5 inches thick. The B2 horizon is dark grayish brown or grayish brown silty clay loam or silty clay. The C horizon is silty clay loam or silty clay. The depth to soft shale is greater than 40 inches.

Daglum soils are on a landscape similar to that of Belfield, Desart, Ekalaka, and Rhoades soils. Unlike Belfield soils, Daglum soils have strong columnar structure. They contain less sand and have more clay than Desart and Ekalaka soils. They have columnar structure at a greater depth than Rhoades soils.

DaB—Daglum fine sandy loam, 1 to 6 percent slopes. This soil is on fans, foot slopes, and uplands and in swales. It has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam. The landscape has a pitted microrelief where the surface layer has been removed by soil blowing.

Included with this soil in mapping are small areas of Vebar, Tally, and Ekalaka soils in similar positions on the landscape.

Runoff is slow to medium. Soil blowing is a moderate hazard. Salinity, alkalinity, and poor structure in the subsoil are the major limitations to use of this soil for crops. Controlling soil blowing and maintaining tilth are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IVs–3P; Claypan range site.

DaC—Daglum fine sandy loam, 6 to 9 percent slopes. This soil is on fans, foot slopes, and uplands and in swales. It has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Vebar, Tally, and Ekalaka soils in similar positions on the landscape.

Runoff is medium. Soil blowing is a serious hazard. Salinity, alkalinity, and poor structure in the subsoil are the main soil limitations. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are in native grass. Capability unit VIs (Claypan); Claypan range site.

DhB—Daglum-Rhoades silty clay loams, 1 to 6 percent slopes. This complex is on fans and uplands and in swales. The Daglum soils have the profile described as representative of the series. The Rhoades soils have a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. The surface has a pitted microrelief.

This complex consists of about 70 percent Daglum soils and 25 percent Rhoades soils. The rest is small areas of Belfield soils in similar positions on the landscape.

Runoff is slow to medium. Soil blowing and erosion are slight hazards. Salinity and alkalinity in the lower part of the subsoil and poor structure in the subsoil are the main limitations. Conserving moisture and maintaining a good grass cover are the main concerns of management.

Most areas of these soils are in native range. Capability unit VIs (Claypan); Daglum part in Claypan range site, Rhoades part in Thin Claypan range site.

Desart Series

The Desart series consists of deep, well drained,

nearly level to gently sloping, moderately coarse textured soils on terraces, fans, and uplands. These soils formed in alluvium and in material weathered from sandstone.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is dark grayish brown fine sandy loam about 19 inches thick. The subsoil is about 11 inches thick. In the upper part it is grayish brown, very hard fine sandy loam about 6 inches thick, and in the lower part it is light brownish gray, extremely hard fine sandy loam about 5 inches thick. The underlying material is pale olive fine sandy loam and loamy fine sand about 12 inches thick and, below that, light olive gray loam.

Permeability is moderately rapid in the surface and subsurface layers and slow in the subsoil and underlying material. The available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are suited to cultivated crops and grass.

Representative profile of Desart fine sandy loam, in an area of Ekalaka-Desart fine sandy loams, 1 to 6 percent slopes, in native grass 100 feet south and 50 feet west of the northeastern corner of the northwest quarter of sec. 32, T. 135 N., R. 99 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; soft, friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

A&B—5 to 24 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; soft, friable, nonsticky and nonplastic; uncoated sand grains on faces of peds; slightly acid; clear wavy boundary.

B21t—24 to 30 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; strong very coarse columnar structure parting to strong coarse subangular blocky; very hard, firm, sticky and plastic; many thin clay films on faces of peds; a 1-inch layer of bleached sand grains on top of columns; neutral; clear wavy boundary.

B22t—30 to 35 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; strong coarse prismatic structure parting to strong coarse angular blocky; extremely hard, firm, sticky and plastic; many thin clay films on faces of peds; lime segregated in soft masses in lower part; very slight effervescence; moderately alkaline; diffuse irregular boundary.

C1—35 to 47 inches; pale olive (5Y 6/3) fine sandy loam and loamy fine sand, olive (5Y 4/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, nonsticky and nonplastic; very slight effervescence; moderately alkaline; gradual wavy boundary.

IIC2—47 to 60 inches; light olive gray (5Y 6/2) loam, olive gray (5Y 4/2) moist; massive; very hard, firm, sticky and slightly plastic; lime segregated in medium sized masses; very slight effervescence; moderately alkaline.

The A1 horizon is grayish brown or dark grayish brown. The A2 horizon, where present, has uncoated sand grains on peds to a depth of 8 inches. The B2 horizon is dark grayish brown, light brownish gray, or grayish brown fine sandy loam or sandy loam.

Desart soils are on a landscape similar to that of Ekalaka, Parshall, and Tally soils. They have a columnar B horizon, which Parshall and Tally soils lack, and which is at a greater depth than that in Ekalaka soils.

Desart soils in Slope County are mapped only in complex with Ekalaka soils.

Dimmick Series

The Dimmick series consists of deep, level, very poorly drained, fine textured soils. These soils formed in slightly concave depressions and lake basins.

In a representative profile the surface layer is about 22 inches thick. The upper part is gray silty clay about 4 inches thick, and the lower part is dark gray silty clay. The underlying material is dark gray silty clay.

Permeability is very slow, and the available water capacity is moderate. Organic-matter content is high, and fertility is medium.

These soils are used mainly for grass and hay. Some areas are used only for wildlife habitat.

Representative profile of Dimmick silty clay, in native grass 1,170 feet west and 210 feet north of the southeastern corner of the northeast quarter of sec. 24, T. 134 N., R. 98 W.

O1—2 inches to 0; mat of roots and partially decomposed vegetable matter.

A11g—0 to 4 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; few fine prominent yellowish brown (10Y 5/6) mottles; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; medium acid; clear wavy boundary.

A12g—4 to 22 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; many fine prominent dark yellowish brown (10YR 4/4) mottles, moist; strong medium prismatic structure parting to strong medium angular blocky; very hard, very firm, very sticky and very plastic; neutral; diffuse irregular boundary.

C1g—22 to 60 inches; dark gray (5Y 4/1) silty clay, dark gray (N 4/0) moist; many fine distinct olive brown (2.5Y 4/4) mottles; massive; very hard, very firm, very sticky and very plastic; neutral.

The A horizon is gray, very dark gray, or black. The depth to carbonates is 25 to more than 60 inches.

Dimmick soils are near Morton, Sen, Farland, Grail, and Savage soils. Dimmick soils are not so well drained as these soils.

Dk—Dimmick silty clay. This soil is in lake basins and depressions. Slopes are 0 to 1 percent.

Included with this soil in mapping are small areas of Heil and McKenzie soils on outer edges of depressions.

Runoff is ponded, and ponding is the main limitation to the use of this soil. This soil is suited to cultivated crops in years when precipitation is below normal or if surface drainage is provided.

This soil is mostly in native range. Capability unit Vw (Wetland); Wetland range site.

Ekalaka Series

The Ekalaka series consists of deep, well drained, nearly level to moderately sloping, moderately coarse textured and coarse textured soils on terraces, fans, and uplands. These soils formed in alluvium and in material weathered from sandstone.

In a representative profile the surface layer is grayish brown fine sandy loam about 11 inches thick. The subsurface layer is grayish brown loamy fine sand about 2 inches thick. The subsoil is 22 inches thick. The upper part is grayish brown, extremely hard fine sandy loam about 7 inches thick. The lower part is grayish brown, extremely hard loamy fine sand about 15 inches thick. The underlying material is grayish brown loamy fine sand about 21 inches thick and, below that, grayish brown calcareous fine sandy loam.

Permeability is moderately rapid in the surface and subsurface layers and slow in the subsoil. The available water capacity is low to moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used for cultivated crops and grazing. Trees do not grow well on these soils.

Representative profile of Ekalaka fine sandy loam, in an area of Ekalaka soils, 1 to 6 percent slopes, in native grass 990 feet east and 90 feet south of the northwestern corner of the northeast quarter of sec. 32, T. 135 N., R. 99 W.

A11—0 to 3 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; slightly hard, friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

A12—3 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure; slightly hard, friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

A2—11 to 13 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak thick platy structure; soft, very friable, nonsticky and nonplastic; moderately alkaline; abrupt smooth boundary.

B2t—13 to 20 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong coarse columnar structure parting to strong coarse subangular blocky; extremely hard, friable, nonsticky and nonplastic; moderately alkaline; gradual wavy boundary.

B3—20 to 35 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to weak coarse subangular blocky; extremely hard, firm, nonsticky and nonplastic; few salt crystals in lower part; moderately alkaline; gradual wavy boundary.

C1—35 to 56 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, very friable, nonsticky and nonplastic; common salt crystals; slight effervescence; moderately alkaline; gradual wavy boundary.

C2—56 to 60 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/3) moist; single grained; very hard, friable, slightly sticky and nonplastic; violent effervescence; moderately alkaline.

The A1 and A2 horizons combined are 10 to 20 inches thick. The A1 horizon is dark grayish brown or grayish brown fine sandy loam or loamy fine sand. The A2 horizon is light brownish gray or grayish brown loamy fine sand or fine sandy loam 1 to 5 inches thick. The B2 horizon is light olive brown, grayish brown, or light brownish gray sandy loam or fine sandy loam.

Ekalaka soils are near Daglum, Desart, Parshall, and Tally soils. They contain less clay than Daglum soils, and they have columnar structure at a shallower depth than Desart soils. Unlike Parshall and Tally soils, Ekalaka soils have a B horizon that has strong columnar structure.

EdB—Ekalaka-Desart fine sandy loams, 1 to 6 percent slopes. This complex is on fans, terraces, and uplands. The Ekalaka soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Desart soil has the profile described as representative of the series.

This complex is about 55 percent Ekalaka soils and 40 percent Desart soils. The rest is Parshall, Tally, and Lihen soils in similar positions on the landscape.

Runoff is slow to medium. Soil blowing is a severe hazard. Salinity and alkalinity in the lower part of the subsoil are the main limitations. Controlling soil blowing, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this complex are in native range. Capability unit IVe-3P; Sandy range site.

EkB—Ekalaka soils, 1 to 6 percent slopes. These soils are on terraces, fans, and uplands. The surface layer ranges from fine sandy loam to loamy fine sand. These soils have the profile described as representative of the series.

Included with these soils in mapping are small areas of Chinook, Rhame, Zeona, and Vebar soils in similar positions on the landscape.

Runoff is slow to medium. Soil blowing is a severe hazard. Salinity and alkalinity in the lower part of the subsoil are the main limitations. Controlling erosion,

conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IVe–3P; Sandy range site.

EkC—Ekalaka soils, 6 to 9 percent slopes. These soils are on terraces, fans, and uplands. The surface layer ranges from fine sandy loam to loamy fine sand.

Included with these soils in mapping are small areas of Zeona, Absher, Fleak, and Rhame soils in similar positions on the landscape and areas of Ekalaka soils that have slopes of 9 to 12 percent.

Runoff is medium. Soil blowing is a severe hazard. Salinity and alkalinity in the lower part of the subsoil are the main limitations. Control of erosion, conservation of moisture, and proper range use are the main concerns of management.

Almost all areas of these soils are in native range. Capability unit VIe (Sandy); Sandy range site.

Farland Series

The Farland series consists of deep, well drained, nearly level to gently sloping, medium textured soils on terraces. These soils formed in alluvium.

In a representative profile the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is calcareous silty clay loam about 13 inches thick. It is pale brown in the upper part and very pale brown in the lower part. The underlying material is light brownish gray calcareous silt loam about 19 inches thick and, below that, light gray calcareous stratified silty clay loam and silt loam.

Permeability is moderate, and the available water capacity is high. Organic-matter content is moderate, and fertility is high.

These soils are used mainly for crops. They are well suited to the crops commonly grown in the county.

Representative profile of Farland silt loam, 1 to 3 percent slopes, in a cultivated field 790 feet south and 260 feet west of the northeastern corner of sec. 3, T. 134 N., R. 102 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; abrupt smooth boundary.

A12—5 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B21t—8 to 16 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate coarse and medium angular blocky; hard, firm, sticky and slightly plastic; few thin clay films on faces of peds; strong effervescence; mildly alkaline; clear wavy boundary.

B22t—16 to 21 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm, sticky and slightly plastic; few thin clay films on faces of peds; strong effervescence; mildly alkaline; clear wavy boundary.

C1ca—21 to 28 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate medium angular blocky; slightly hard, firm, sticky and slightly plastic; few small soft masses of segregated lime; violent effervescence; mildly alkaline; clear wavy boundary.

C2—28 to 40 inches; light grayish brown (2.5Y 6/2) silt loam, dark brownish gray (2.5Y 4/2) moist; moderate coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few small soft masses of segregated lime; few small gravel pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—40 to 60 inches; light gray (2.5Y 7/2) stratified silty clay loam and silt loam, light yellowish brown (2.5Y 6/3) moist; weak coarse subangular blocky structure; hard, firm, sticky and slightly plastic; strong effervescence; moderately alkaline.

The A horizon is 6 to 8 inches thick. The B2t horizon is clay loam or silty clay loam.

Farland soils are associated with Golva, Belfield, Savage, Shambo, and Stady soils. Unlike Golva and Shambo soils, Farland soils have a Bt horizon. They lack a gravelly IIC horizon, which Stady and Shambo soils have. Farland soils contain less clay than Savage soils.

FaA—Farland silt loam, 1 to 3 percent slopes. This soil is on terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Rhoades and Belfield soils on terraces. Scab spots and a pitted microrelief are in areas of the Rhoades soils.

Runoff is slow. Climate is the only limitation to the use of this soil for crops. Maintaining fertility and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIc–6; Silty range site.

FaB—Farland silt loam, 3 to 6 percent slopes. This soil is on terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Farland soils that have slopes of 6 to 9 percent and Rhoades and Belfield soils on terraces. Scab spots and a pitted microrelief are in areas of the Rhoades soils.

Runoff is medium. Soil blowing is a slight hazard. The main concern of management is conserving moisture and maintaining fertility.

Almost all areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

Flasher Series

The Flasher series consists of shallow, somewhat excessively drained, gently sloping to very steep, moderately coarse textured and coarse textured soils on uplands. These soils formed in weathered sandstone.

In a representative profile the surface layer is grayish brown sandy loam about 5 inches thick. The underlying material is light yellowish brown loamy sand about 6 inches thick, light gray fine sand about 4 inches thick and, below that, light gray soft sandstone.

Permeability is rapid, and the available water capacity is very low. Organic-matter content and fertility are low.

Most areas of these soils are in native grass. They are poorly suited to cultivated crops and trees.

Representative profile of Flasher sandy loam, in an area of Flasher soils, 15 to 40 percent slopes, in native grass 50 feet north and 30 feet east of the southwestern corner of the northwest quarter of sec. 2, T. 135 N., R. 100 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; slightly hard, very friable, nonsticky and nonplastic; neutral; gradual smooth boundary.

C1—5 to 11 inches; light yellowish brown (2.5Y 6/4) loamy sand, olive brown (2.5Y 4/4) moist; single grained; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline; gradual smooth boundary.

C2—11 to 15 inches; light gray (2.5Y 7/2) fine sand, grayish brown (2.5Y 5/2) moist; single grained; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

C3—15 to 60 inches; light gray (5Y 7/2) soft sandstone; olive gray (5Y 5/2) moist; massive crushing to single grained; disseminated lime; strong effervescence; mildly alkaline.

The A horizon is grayish brown, brown, or light grayish brown fine sandy loam, sandy loam, or loamy fine sand. The C horizon is loamy sand, loamy fine sand, or fine sand. The depth to soft sedimentary beds is 7 to 20 inches.

Flasher soils are on a landscape similar to that of Vebar, Tally, and Cabba soils. Flasher soils are shallower than Vebar and Tally soils. They contain more sand and less lime than Cabba soils.

FbE—Flasher-Badland complex, 9 to 40 percent slopes. This mapping unit is on uplands. Badland consists of sandstone and shale outcrops. This complex consists of about 70 percent Flasher soils and 25 percent Badland that is undergong geologic erosion.

Included with these soils in mapping are small areas of Vebar, Wayden, and Cabba soils on foot slopes.

Runoff is medium. Soil blowing and water erosion are severe hazards. Proper range use that maintains a good grass cover is the main concern of management.

This complex is mostly in native range. Capability unit VIIe (Shallow); Flasher part in Shallow range site, Badland part not assigned to a range site.

FhD—Flasher soils, 3 to 15 percent slopes. These soils are on uplands. They have a profile similar to the one described as representative of the series, but the surface layer is thicker. Flasher soils in this mapping unit have a surface layer that ranges from loamy fine sand to fine sandy loam.

Included with these soils in mapping are small areas of Vebar, Cabba, and Wayden soils on uplands. A few outcrops of hard sandstone are in some places. These outcrops are designated on the maps by a special symbol.

Runoff is slow to medium. Soil blowing is a severe hazard. Maintaining a good grass cover and conserving moisture are the main concerns of management.

Most areas of these soils are in native range. Capability unit VIe (Shallow); Shallow range site.

FhE—Flasher soils, 15 to 40 percent slopes. These soils are on uplands. They have the profile described as representative of the series. Flasher soils in this mapping unit have a surface layer that ranges from loamy fine sand to fine sandy loam.

Included with these soils in mapping are small areas of Vebar, Cabba, and Wayden soils on uplands. Hard sandstone outcrops are in some places. These places are shown on the map by the symbol for rock outcrop.

Runoff is medium. Soil blowing is a severe hazard. Proper range use that maintains a good grass cover is the main concern of management.

Most areas of these soils are in native range. Capability unit VIIe (Shallow); Shallow range site.

Fleak Series

The Fleak series consists of shallow, excessively drained, gently sloping to very steep, coarse textured and moderately coarse textured soils on uplands. These soils formed in weathered sandstone.

In a representative profile the surface layer is grayish brown loamy fine sand about 4 inches thick. The underlying material is light gray calcareous loamy fine sand about 15 inches thick and, below that, pale yellow soft sandstone.

Permeability is rapid, and the available water capacity is low. Organic-matter content and fertility are low.

Most areas of these soils are in native grass. They are not suited to cultivated crops or trees.

Representative profile of Fleak loamy fine sand, in an area of Fleak soils, 3 to 15 percent slopes, in native grass 770 feet north and 380 feet east of the southwestern corner of the northwest quarter of sec. 8, T. 134 N., R. 104 W.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, nonsticky and nonplastic; slight effervescence; neutral; clear smooth boundary.

C1—4 to 16 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; massive parting to single grained; loose, nonsticky and nonplastic; violent effervescence; mildly alkaline; gradual wavy boundary.

C2—16 to 19 inches; light gray (2.5Y 7/2) loamy fine sand, light olive brown (2.5Y 5/3) moist; weakly consolidated sandstone crushing under pressure to single grained; loose, nonsticky and nonplastic; violent effervescence; mildly alkaline; clear wavy boundary.

C3—19 to 40 inches; pale yellow (5Y 7/3) soft sandstone, olive (5Y 5/3) moist; single grained; few hard sandstone fragments; violent effervescence; mildly alkaline.

The A horizon is grayish brown or light brownish gray loamy fine sand or fine sandy loam. The depth to soft sandstone is 7 to 20 inches.

Fleak soils are near Cabbart, Zeona, and Rhame soils. They contain more sand than Cabbart soils. They are not so deep as Zeona and Rhame soils.

FkE—Fleak-Badland complex, 9 to 40 percent slopes. This mapping unit is on uplands. The Fleak soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Badland consists of blowouts, breaks, sandstone outcrops, ledges, and gullies. Some of the mapped areas are undergoing geologic erosion. This complex consists of about 60 percent Fleak soils and 25 percent Badland.

Runoff is rapid. Water erosion is a severe hazard. Proper range use that maintains a good grass cover is the main concern of management.

All of this complex is in native range. Capability unit VIIe (Shallow); Fleak part in Shallow range site, Badland part not assigned to a range site.

FlD—Fleak soils, 3 to 15 percent slopes. These soils are on uplands. They have the profile described as representative of the series, but the surface layer ranges from loamy fine sand to fine sandy loam.

Included with these soils in mapping are Rhame, Ekalaka, and Zeona soils on uplands and Glendive soils on terraces and fans. Slips, breaks, rock outcrops, and Badland make up about 10 percent of this unit.

Runoff is medium to rapid. Soil blowing is a severe hazard. Low available water capacity is the main limitation. Proper range use that maintains a good grass cover is the main concern of management.

These soils are mostly in native range. Capability unit VIe (Shallow); Shallow range site.

FlE—Fleak soils, 15 to 40 percent slopes. These soils are on uplands. They have a profile similar to the one described as representative of the series, but the surface layer is thinner and ranges from loamy fine sand to fine sandy loam.

Included with these soils in mapping are Rhame soils on uplands, and slips, breaks, rock outcrops, and Badland.

Runoff is rapid. Soil blowing and water erosion are severe hazards. Proper range use that maintains a good grass cover is the main concern of management.

All areas of these soils are in native range. Capability unit VIIe (Shallow); Shallow range site.

Fluvaquentic Haplaquolls

Fu—Fluvaquentic Haplaquolls. These are very poorly drained soils in drainageways below springs and seeps. Most areas are small. The soils remain wet most of the time because of a high water table, and they are occasionally flooded. Slopes are 0 to 1 percent.

Included with these soils in mapping are small areas of saline soils.

These soils are used mostly for grazing. Some areas are used for wildlife habitat. Grazing is limited because of wetness. Capability unit Vw (Wetland); Wetland range site.

Glendive Series

The Glendive series consists of deep, well drained to moderately well drained, nearly level to gently sloping, moderately coarse textured soils on terraces and fans. These soils formed in alluvium.

In a representative profile the surface layer is light brownish gray fine sandy loam about 7 inches thick. The underlying material is dark grayish brown and light brownish gray fine sandy loam about 5 inches thick in the upper part, grayish brown and light brownish gray fine sandy loam about 28 inches thick in the middle part, and olive gray and light olive gray stratified loamy fine sand and fine sandy loam about 20 inches thick in the lower part.

Permeability is moderately rapid, and the available water capacity is moderate. Organic-matter content is moderately low, and fertility is medium.

These soils are used for crops and grazing. They are suited to irrigation.

Representative profile of Glendive fine sandy loam, 1 to 3 percent slopes, in a cultivated field 866 feet south and 50 feet west of the center of sec. 30, T. 133 N., R. 105 W.

Ap—0 to 7 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium crumb structure; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline; abrupt smooth boundary.

C1—7 to 12 inches; dark grayish brown and light brownish gray (2.5Y 4/2 and 6/2) fine sandy loam, very dark grayish brown and dark grayish brown (10YR 3/2 and 4/2) moist; weak coarse subangular blocky structure; hard, very friable, nonsticky and nonplastic; slight effervescence; moderately alkaline; clear smooth boundary.

C2—12 to 20 inches; grayish brown and light brownish gray (2.5Y 5/2 and 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2 and 4/3) moist; weak coarse subangular blocky structure; hard, very friable, nonsticky and nonplastic; segregated lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C3—20 to 40 inches; grayish brown and light gray (2.5Y 5/2 and 6/2) fine sandy loam, dark grayish brown and grayish brown (2.5Y 4/2 and 5/2) moist; weak coarse subangular blocky structure; hard, very friable, nonsticky and nonplastic; segregated lime; strong effervescence; mod-

erately alkaline; gradual smooth boundary.

C4—40 to 60 inches; olive gray and light olive gray (5Y 5/2 and 6/2) stratified loamy fine sand and fine sandy loam, olive (5Y 4/3 and 5/3) moist; weak coarse subangular blocky structure; soft, very friable nonsticky and nonplastic; slight effervescence; strongly alkaline.

The C horizon is fine sandy loam and stratified loam or silt loam. Thin stratified layers of coarse sand or gravel are in some places.

Glendive soils are near Hanly and Havre soils. They contain more clay than Hanly soils and less clay than Havre soils.

GlA—Glendive fine sandy loam, 1 to 3 percent slopes. This soil is on terraces and fans. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Hanly and Havre soils on bottom lands and terraces.

Runoff is slow. This soil is subject to flooding at times in spring and after seasonal storms. Soil blowing is a moderate hazard. Controlling erosion, maintaining fertility, and conserving moisture are the main concerns of management. Some areas are suitable for irrigation.

Most areas of this soil are used for native range. Capability unit IIIe–3; Overflow range site.

GlB—Glendive fine sandy loam, 3 to 6 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are areas of Havre and Hanly soils on terraces and bottom lands.

Runoff is slow to medium. Soil blowing and water erosion are moderate hazards. This soil is subject to flooding from runoff in spring and after seasonal storms. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–3; Sandy range site.

Golva Series

The Golva series consists of deep, well drained, gently sloping to moderately sloping, medium textured soils on fans and terraces and in shallow swales. These soils formed in alluvium.

In a representative profile the surface layer is grayish brown silt loam about 5 inches thick. The subsoil is about 27 inches thick. In the upper part it is grayish brown silt loam about 10 inches thick, in the middle part it is light brownish gray calcareous silt loam about 11 inches thick. The underlying material is pale yellow calcareous silt loam.

Permeability is moderate, and the available water capacity is high. Organic-matter content is moderate, and fertility is high.

Those soils are well suited to cultivated crops and grass.

Representative profile of Golva silt loam, in an area of Grassna and Golva silt loams, 3 to 6 percent slopes, in native grass 1,630 feet north and 2,000 feet west of the southeastern corner of sec. 36, T. 133 N., R. 104 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B21—5 to 15 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; moderate coarse and medium prismatic structure; slightly hard; friable, slightly sticky and slightly plastic; mildly alkaline; gradual wavy boundary.

B22—15 to 21 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

B3ca—21 to 32 inches; pale yellow (2.5Y 7/3) silt loam, olive brown (2.5Y 4/3) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; intermittent pebble line at bottom of horizon; strong effervescence; moderately alkaline; clear smooth boundary.

C1ca—32 to 40 inches; pale yellow (5Y 8/3) silt loam, olive (5Y 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; abrupt wavy boundary.

C2—40 to 60 inches; pale yellow (5Y 8/3) silt loam, olive (5Y 5/3) moist; massive parting to weak thick platy structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

The A horizon is 4 to 10 inches thick. The B2 horizon is grayish brown, light brownish gray, or brown silt loam or silty clay loam. The depth to carbonates is 10 to 22 inches.

Golva soils are on a landscape similar to that of Grassna, Farland, Sen, and Shambo soils. Golva soils have a thinner A horizon than Grassna soils and are deeper than Sen soils. They lack a Bt horizon, which Farland soils have, and they lack gravelly IIC2 horizon, which Shambo soils have.

GoC—Golva silt loam, 6 to 9 percent slopes. This soil is on fans and terraces and in swales. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are small areas of Grassna soils in similar positions on the landscape.

Runoff is medium. Water erosion is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6; Silty range site.

Grail Series

The Grail series consists of deep, well drained, nearly level to gently sloping, moderately fine textured and medium textured soils in swales and depressions. These soils formed in material that was washed from adjacent slopes.

In a representative profile the surface layer is dark grayish brown silty clay loam about 12 inches thick. The subsoil is about 15 inches thick. The upper part is dark grayish brown silty clay about 6 inches thick, and the lower part is grayish brown silty clay about 9 inches thick. The underlying material is light olive gray calcareous silty clay loam.

Permeability is moderately slow, and the available water capacity is high. Organic-matter content and fertility are high.

These soils are mostly cultivated, and they are suited to all cultivated crops grown in the county.

Representative profile of Grail silty clay loam, 1 to 3 percent slopes, in cropland 140 feet north and 35 feet east of the southwestern corner of the southeast quarter of sec. 3, T. 135 N., R. 98 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; very hard, firm, sticky and slightly plastic; neutral; abrupt smooth boundary.

A12—5 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate coarse and medium subangular blocky structure; very hard, firm, sticky and slightly plastic; neutral; clear wavy boundary.

B21t—12 to 18 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate medium angular blocky; very hard, firm, very sticky and plastic; continuous thick clay films on faces of peds; neutral; clear wavy boundary.

B22t—18 to 27 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to moderate medium angular blocky; very hard, firm, very sticky and plastic; continuous thick clay films on faces of peds; mildly alkaline; clear wavy boundary.

C1ca—27 to 60 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; few fine olive brown (2.5Y 4/4) mottles; weak coarse and medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few small soft masses of lime; violent effervescence; mildly alkaline.

The solum is 20 inches to more than 40 inches thick. The A horizon is silt loam or silty clay loam. The B2t horizon is silty clay loam, clay loam, or silty clay.

Grail soils are near Arnegard, Reeder, Regent, and Savage soils. They contain more clay than Arnegard and Reeder soils. Grail soils have a thicker A horizon than Regent and Savage soils.

GrA—Grail silt loam, 1 to 3 percent slopes. This soil is in swales and depressions. It has a profile similar to the one described as representative of the series, but the surface layer is silt loam.

Included with this soil in mapping are small areas of Grassna and Belfield soils in swales and depressions. Also included are some saline areas that are shown on the map by a special symbol.

Runoff is slow. Maintaining fertility and conserving moisture are the only concerns of management.

Most areas of this soil are cultivated. Capability unit IIc–6; Overflow range site.

GrB—Grail silt loam, 3 to 6 percent slopes. This soil is in swales and depressions. It has a profile similar to the one described as representative of the series, but the surface layer is silt loam.

Included with this soil in mapping are small areas of Arnegard soils in swales and depressions and Morton, Regent, and Moreau soils on uplands.

Runoff is medium. Water erosion is a slight hazard. Controlling erosion and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

GtA—Grail silty clay loam, 1 to 3 percent slopes. This soil is in swales and depressions. It has the profile described as representative of the series.

Included with this soil in mapping are Regent, Morton, and Moreau soils on uplands and Belfield soils in swales and depressions. Small saline areas are included and shown on the map by a special symbol.

Runoff is slow. Maintaining tilth and fertility is the main concern of management.

Most areas of this soil are used for cultivated crops. Capability unit IIc–7; Overflow range site.

GtB—Grail silty clay loam, 3 to 6 percent slopes. This soil is in swales and shallow depressions. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are small areas of Belfield and Savage soils in swales and depressions and Morton and Regent soils on uplands.

Runoff is medium. Water erosion is a slight hazard. Maintaining fertility and tilth and controlling erosion are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIe–7; Silty range site.

Grassna Series

The Grassna series consists of deep, well drained, nearly level to gently sloping, medium textured soils in swales and on fans and foot slopes. These soils formed in material that was washed from adjacent slopes.

In a representative profile the surface is about 15 inches thick. The upper part is grayish brown silt loam about 7 inches thick, and the lower part is dark grayish brown silt loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part is dark grayish brown silt loam about 6 inches thick, and the lower

part is grayish brown calcareous silt loam about 10 inches thick. The underlying material is light brownish gray calcareous silt loam.

Permeability is moderate, and the available water capacity is high. Organic-matter content and fertility are high.

These soils are well suited to cultivated crops, grasses, and trees commonly grown in the county. Almost all of these soils are cultivated.

Representative profile of Grassna silt loam, in an area of Grassna and Golva silt loams, 3 to 6 percent slopes, in cropland 1,320 feet east and 70 feet north of the southwestern corner of sec. 17, T. 133 N., R. 101 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, very friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

A12—7 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and fine subangular blocky structure parting to weak fine granular; hard, very friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

B21—15 to 21 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

B22—21 to 31 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and very fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; clear wavy boundary.

C1ca—31 to 45 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; weak very coarse prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few small masses of lime; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—45 to 51 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C3—51 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

The A horizon is grayish brown or dark grayish brown and is 10 to 20 inches thick. The B2 horizon is 14 to 25 inches thick. It has weak to moderate prismatic structure parting to angular or subangular blocky structure.

Grassna soils are near Arnegard, Golva, Grail, Morton, and Sen soils. They contain more silt and less sand than Arnegard soils, and they have a thicker A horizon than Golva soils. Grassna soils are deeper than Morton and Sen soils, and they contain less clay than Grail soils.

GwA—Grassna silt loam, 1 to 3 percent slopes. This soil is on fans and foot slopes and in swales. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are Grassna soils that have a silty clay loam surface layer.

Runoff is slow. Maintaining fertility and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIc–6; Overflow range site.

GxB—Grassna and Golva silt loams, 3 to 6 percent slopes. This mapping unit is an undifferentiated group consisting of soils on fans and foot slopes and in swales. These soils have the profile described as representative of their series. Some areas consist of only Grassna silt loam or Golva silt loam, and some consist of both soils.

Runoff is medium. Water erosion is a slight hazard. Controlling erosion and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

Hanly Series

The Hanly series consists of deep, somewhat excessively drained, nearly level, coarse textured soils on bottom lands. These soils formed in alluvium.

In a representative profile the surface layer is light brownish gray loamy fine sand about 5 inches thick. The underlying material is grayish brown loamy sand about 9 inches thick and, below that, light brownish gray and grayish brown loamy sand and loamy fine sand.

Permeability is rapid, and the available water capacity is low. Organic-matter content is moderate, and fertility is low.

These soils are suited to grass and legumes. Most areas are in native range.

Representative profile of Hanly loamy fine sand, in an area of Hanly soils, 1 to 3 percent slopes, in native grass 100 feet south and 90 feet east of the northwest corner of sec. 27, T. 135 N., R. 105 W.

A1—0 to 5 inches; light brownish gray (2.5Y 6/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; weak fine granular parting to single grained; soft, very friable, nonsticky and nonplastic; slight effervescence; mildly alkaline; clear smooth boundary.

C1—5 to 14 inches; grayish brown (2.5Y 5/2) loamy sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, nonsticky and nonplastic; slight effervescence; abrupt smooth boundary.

C2—14 to 16 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; few large brownish

yellow (10YR 6/6) mottles; moderate thin platy structure; slightly hard, very friable, slightly sticky and nonplastic; slight effervescence; mildly alkaline; abrupt smooth boundary.

C3—16 to 60 inches; light brownish gray and grayish brown (2.5Y 6/2 and 5/2) loamy sand and loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, nonsticky and nonplastic; slight effervescence; mildly alkaline.

The A horizon is light brownish gray, grayish brown, or light gray loamy fine sand or sandy loam 2 to 7 inches thick. Thin, dark colored layers are in some places.

Hanly soils are on a landscape similar to that of Glendive and Havre soils. Hanly soils contain more sand than these soils.

HaA—Hanly soils, 1 to 3 percent slopes. These soils are on bottom lands. The surface layer ranges from loamy fine sand to loamy sand or sandy loam.

Included with these soils in mapping are small areas of Glendive and Havre soils on terraces and fans (fig. 8).

Runoff is slow. Soil blowing is a severe hazard. These soils are subject to flooding in spring and after severe storms. Proper range use and conserving moisture are the main concerns of management.

Almost all areas of these soils are used for native range or hay. Capability unit VIe (Thin Sands) ; Thin Sands range site.

Harriet Series

The Harriet series consists of deep, poorly drained, level claypan soils. These soils formed in alluvium on nearly level bottom lands.

In a representative profile the surface layer is gray loam about 4 inches thick. The subsoil is about 15 inches thick. The upper part of the subsoil is dark grayish brown clay loam about 7 inches thick, and the lower part is grayish brown silty clay about 8 inches thick. The underlying material is light gray calcareous silty clay about 25 inches thick and, below that light olive gray silty clay loam.

Permeability is slow, and the available water capacity is moderate. Organic-matter content is moderately low, and fertility is low.

These soils are suited to salt-tolerant native grasses. They are used mainly for grazing.

Representative profile of Harriet loam, in an area of Harriet complex, 1,060 feet north and 70 feet west of the southeastern corner of sec. 24, T. 134 N., R. 99 W.

A2—0 to 4 inches; gray (10YR 6/1) loam, dark gray (10YR 4/1) moist; weak medium and fine granular structure; soft, friable,

Figure 8.—**Hanly soils, 1 to 3 percent slopes, are on the low terraces (foreground) along Little Missouri River. The hayfield on higher terraces is on Havre soils, 1 to 3 percent slopes.**

nonsticky and nonplastic; moderately alkaline; abrupt smooth boundary.

B2t—4 to 11 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; gray (N 5/0) on the top and sides of columns; strong medium columnar structure parting to moderate medium angular blocky; hard, firm, sticky and plastic; strongly alkaline; gradual wavy boundary.

B3cs—11 to 19 inches; grayish brown (10YR 52) silty clay, very dark grayish brown (10YR 3/2) moist; strong medium angular blocky structure; very hard, very firm, very sticky and very plastic; common salt crystals; slight effervescence; strongly alkaline; clear wavy boundary.

C1cacs—19 to 44 inches; light gray (5Y 6/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse angular blocky structure; very hard, very firm, very sticky and very plastic; many salt crystals; strong effervescence; strongly alkaline; gradual wavy boundary.

C2—44 to 60 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 4/2) moist; massive; hard, firm, very sticky and plastic; many salt crystals; slight effervescence; moderately alkaline; abrupt smooth boundary.

A thin A1 horizon is in some places. The A2 horizon is loam, silt loam, or very fine sandy loam. The B2t horizon is clay loam, silty clay loam, silty clay, or clay. The C horizon has stratified layers that range from sandy loam to silty clay. Salts are visible at a depth of 4 to 11 inches.

Harriet soils are near Korchea, Farland, and Rhoades soils. Harriet soils are poorly drained, and these soils are well drained.

Hc—Harriet complex. This complex is in depressions and bottom lands. The Harriet soil has the profile described as representative of the series. Slopes are 0 to 1 percent.

This complex consists of about 60 percent Harriet soils, 10 percent Rhoades soils, 10 percent Korchea soils, and 15 percent Borolls, saline, in similar positions on the landscape. Also included are small areas of Ekalaka and Desart soils on convex slopes.

Runoff is slow. The water table is at or above a depth of 5 feet most of the year. These soils are subject to flooding and ponding in some places. Salinity and alkalinity and poor drainage are the chief limitations. Proper range use is the main concern of management.

Almost all areas of this complex are in native range. Capability unit VIw (Saline Lowland) ; Saline Lowland range site.

Havre Series

The Havre series consists of deep, well drained, nearly level and channeled, medium textured and moderately fine textured soils on stream terraces. These soils formed in alluvium.

In a representative profile the surface layer is light brownish gray silt loam about 6 inches thick. The underlying material is stratified, calcareous, light brownish gray silt loam, loam, and fine sandy loam.

Permeability is moderate, and the available water capacity is moderate to high. Organic-matter content is moderate, and fertility is medium.

These soils are suited to small grain, hay, and pasture. They are suited to irrigation.

Representative profile of Havre silt loam, in an area of Havre soils, 1 to 3 percent slopes, in native grass 700 feet south and 400 feet west of the northwestern corner of the southeast quarter of sec. 30, T. 135 N., R. 102 W.

A1—0 to 6 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak medium angular blocky structure parting to weak medium granular; hard, friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

C1—6 to 20 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) and very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slight effervescence; moderately alkaline; gradual smooth boundary.

C2—20 to 28 inches; light brownish gray (2.5Y 6/2) and grayish brown (10YR 5/2) loam, dark grayish brown (2.5Y 4/2) and very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium angular blocky; hard, friable, slightly sticky and nonplastic; strong effervescence; moderately alkaline; gradual smooth boundary.

C3—28 to 32 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; strong effervescence; moderately alkaline; gradual smooth boundary.

C4—32 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; slight effervescence; moderately alkaline.

The A horizon is silt loam or silty clay loam. The C horizon is stratified loam or silt loam, and thin bands of sandy loam, sand, or gravel are in some places.

Havre soils are on a landscape similar to that of Glendive and Korchea soils. They contain more clay than Glendive soils, and they lack the IIC horizon which Korchea soils have.

HeA—Havre soils, 1 to 3 percent slopes. These soils are on stream terraces. They have a profile similar to the one described as representative of the series, but the surface layer ranges from silt loam to loam or silty clay loam.

Included with these soils in mapping are small areas of Glendive and Korchea soils on stream terraces.

Runoff is slow. These soils are subject to flooding at times in spring and after seasonal storms (fig. 9). Soil blowing is a moderate hazard. Controlling erosion, maintaining fertility, and conserving moisture are the main concerns of management.

These soils are used for crops, hay, and pasture. In

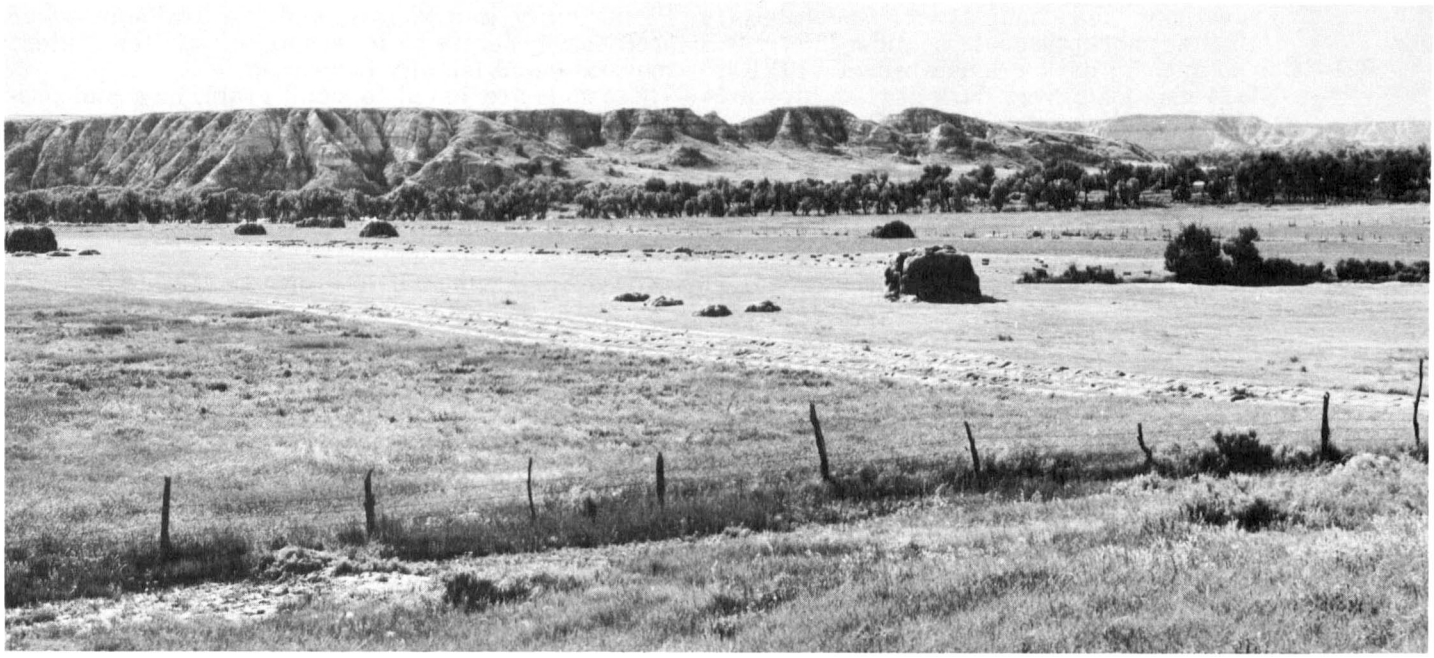

Figure 9.—**This hayland on Havre soils, 1 to 3 percent slopes, is subject to seasonal flooding by the Little Missouri River, which follows the line of trees in the background. The breaks on the horizon are Badland.**

some areas they are suited to irrigation. Capability unit IIIe–6; Overflow range site.

Heil Series

The Heil series consists of deep, poorly drained, level, fine textured soils in depressions. These soils formed in alkaline clayey alluvium in closed depressions.

In a representative profile the surface layer is light gray silty clay, about 3 inches thick; that has fine dark brown mottles. The subsoil is about 35 inches thick. The upper part is gray silty clay 21 inches thick, and the lower part is light gray, slightly calcareous silty clay 14 inches thick. The underlying material is light gray silty clay about 6 inches thick and, below that, pale olive calcareous silty clay.

Permeability is very slow, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are suited to native grass. They are used for hay and pasture.

Representative profile of Heil silty clay, in an area of Heil and McKenzie soils, in native grass 650 feet west and 20 feet south of the northeastern corner of sec. 14, T. 135 N., R. 100 W.

A2—0 to 3 inches; light gray (10YR 6/1) silty clay, dark gray (10YR 4/1) moist; common fine prominent brown (10YR 5/3) and dark brown (10YR 4/3) mottles; moderate fine subangular blocky structure and weak thin platy structure; very hard, firm, stickly and plastic; neutral; abrupt wavy boundary.

B21t—3 to 7 inches; gray (N 5/0) silty clay, very dark gray (N 3/0) moist; strong coarse and medium columnar structure parting to strong coarse medium and fine angular blocky; extremely hard, very firm, sticky and plastic; mildly alkaline; gradual smooth boundary.

B22t—7 to 24 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; strong very coarse prismatic structure parting to strong coarse and medium angular blocky; extremely hard, very firm, very sticky and very plastic; few patches of material from the A2 horizon on peds; moderately alkaline; gradual wavy boundary.

B3—24 to 38 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; moderate coarse angular blocky structure parting to strong fine angular blocky; extremely hard, very firm, very sticky and very plastic; slight effervescence; moderately alkaline; gradual wavy boundary.

C1g—38 to 44 inches; light gray (5Y 6/1) silty clay, dark gray (5Y 4/1) moist; weak coarse and fine angular blocky structure; very hard, very firm, sticky and plastic; few gypsum crystals; slight effervescence; moderately alkaline; diffuse irregular boundary.

C2g—44 to 52 inches; pale olive (5Y 6/3) silty clay, olive (5Y 4/3) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; common gypsum crystals; strong effervescence;

strongly alkaline; gradual wavy boundary.

C3g—52 to 60 inches; pale olive (5Y 6/3) silty clay, olive (5Y 5/4) moist; many strong brown (7.5YR 5/6), yellowish brown (10YR 5/6), and gray (5Y 5/1) mottles; massive; very hard, very firm, sticky and plastic; few large masses of lime; slight effervescence; moderately alkaline.

The depth to carbonates is 15 inches to more than 38 inches. A dark colored A1 horizon that is 1 to 3 inches thick and that has platy structure is in some places. The A2 horizon is light gray or gray silt loam, silty clay loam, or silty clay and is 1 to 4 inches thick. The B2 horizon is silty clay or clay. It ranges from mildly alkaline to strongly alkaline. The columns and prisms range from 2 to 24 inches in width. The B3 horizon is noncalcareous in some places. The C horizon ranges from clay loam to clay.

Heil soils are on a landscape similar to that of McKenzie and Dimmick soils. Unlike these soils, Heil soils have an A2 horizon and columnar structure in the B horizon.

Hz—Heil and McKenzie soils. This mapping unit is in depressions. The soils have the profile described as representative of their series. The surface layer ranges from silt loam to clay. Slopes are 0 to 1 percent.

Mapped areas may consist of only Heil soils, only McKenzie soils, or different amounts of each. Included with these soils in mapping are small areas of Dimmick soils in depressions.

Runoff is ponded. Ponding and salinity are severe limitations to the use of these soils. The proper use of range is the main concern of management.

All areas of these soils are in native range. Capability unit VIs (Closed Depression) ; Closed Depression range site.

Korchea Series

The Korchea series consists of deep, well drained, nearly level to gently sloping, medium textured soils on bottom lands and terraces. These soils formed in alluvium.

In a representative profile the surface layer is grayish brown loam about 6 inches thick. The underlying material is light brownish gray loam about 5 inches thick in the upper part. Below this it is light brownish gray fine sandy loam about 7 inches thick, light gray stratified loam and fine sandy loam about 15 inches thick, and light brownish gray stratified loam and silt loam about 27 inches thick.

Permeability is moderate, and the available water capacity is high. Organic-matter content is moderate, and fertility is medium.

These soils are used for cultivated crops, hay, and pasture. They are suited to irrigation.

Representative profile of Korchea loam, 1 to 3 percent slopes, in cropland, 570 feet west and 530 feet north of the center of sec. 26, T. 136 N., R. 99 W.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) loam very dark grayish brown (2.5Y 3/2) moist; weak medium and fine granular structure; soft, friable, slightly sticky and nonplastic; moderately alkaline; abrupt smooth boundary.

C1—6 to 11 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; soft, friable, slightly sticky and slightly plastic; slight effervescence; moderately alkaline; clear wavy boundary.

IIC2—11 to 18 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; nonsticky and nonplastic; slight effervescence; mildly alkaline; clear wavy boundary.

IIC3—18 to 33 inches; light gray (2.5Y 7/2) stratified loam and fine sandy loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure parting to moderate thick platy; soft, friable, slightly sticky and nonplastic; slight effervescence; moderately alkaline; clear wavy boundary.

IIC4—33 to 60 inches; light brownish gray (2.5Y 6/2) stratified loam and silt loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, slightly sticky and nonplastic; slight effervescence; moderately alkaline.

The A horizon is dark grayish brown or grayish brown. The C horizon is stratified loam, silt loam, and very fine sandy loam. Stratified layers are finer textured or coarser textured in some places.

Korchea soils are on a landscape similar to that of Havre and Farland soils. Unlike Havre and Farland soils, Korchea soils have a IIC horizon.

KcA—Korchea loam, 1 to 3 percent slopes. This soil is on bottom lands and terraces. It has the profile described as representative of the series.

Included with this soil in mapping are Korchea soils that have a surface layer of silty clay loam or that have slopes of 3 to 6 percent and soils that have a thicker, dark colored surface layer and subsoil.

Runoff is slow, and this soil is subject to flooding in some years. The main concerns of management are conserving moisture and maintaining fertility.

Most areas of this soil are cultivated. Capability unit IIc–6; Overflow range site.

Kh—Korchea and Havre soils, channeled. This mapping unit is an undifferentiated group of soils on bottom lands and terraces. The surface layer is uneven, and the areas are dissected by channels that have steep sides and that are uncrossable by farm machinery in most places. The surface layer ranges from loam to silty clay loam. Slopes are 1 to 6 percent.

This mapping unit may consists of almost all Korchea soils, almost all Havre soils, or different amounts of each. Included with this soil in mapping are small areas of Cabba, Cabbart, Shambo, Kremlin, Rhoades, Absher, and Belfield soils on uplands and terraces.

Runoff is medium. These soils are subject to flooding at times in spring and after severe storms. Proper range use is the main concern of management.

Almost all areas of these soils are in native range. Capability unit VIe (Overflow) ; Overflow range site.

Kremlin Series

The Kremlin series consists of deep, well drained, nearly level to moderately sloping, medium textured soils on fans and terraces. These soils formed in alluvium.

In a representative profile the surface layer is grayish brown loam about 9 inches thick. The subsoil is pale yellow loam about 17 inches thick. The lower part is calcareous. The underlying material is pale yellow calcareous loam about 5 inches thick and, below that, light gray calcareous loam about 19 inches thick. Below that, it is light gray sandy clay loam.

Permeability is moderate, and the available water capacity is high. Organic-matter content is moderate, and fertility is medium.

These soils are used for crops, hay, and pasture. They are suited to cultivated crops and trees commonly grown in the county. In some areas they are suited to irrigation.

Representative profile of Kremlin loam, 6 to 9 percent slopes, in a cultivated field 510 feet north and 700 feet west of the center of sec. 7, T. 136 N., R. 103 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; slightly hard, friable, slightly sticky and nonplastic; mildly alkaline; abrupt smooth boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; mildly alkaline; clear wavy boundary.

B2—9 to 18 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; few small soft masses of lime; strong effervescence; mildly alkaline; clear wavy boundary.

B3ca—18 to 26 inches; pale yellow (2.5Y 7/4) loam, light olive brown (2.5YR 5/4) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable, slightly sticky and nonplastic; few small soft masses of lime; violent effervescence; mildly alkaline; gradual wavy boundary.

C1ca—26 to 31 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; moderate coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; small soft masses of segregated lime; violent effervescence; mildly alkaline; clear wavy boundary.

C2—31 to 50 inches; light gray (2.5Y 7/2) loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; small soft masses of segregated lime; common small ironstone concretions; strong effervescence; mildly alkaline; clear wavy boundary.

IIC3—50 to 60 inches; light gray (5Y 7/2) sandy clay loam, olive gray (5Y 5/2) moist; massive; very hard, firm, sticky and plastic; large soft masses of segregated lime; slight effervescence; moderately alkaline.

The A horizon is grayish brown or brown and is 6 to 10 inches thick. The B2 horizon is loam, silt loam, or clay loam. The C horizon is stratified loam, silt loam, or clay loam. Thin stratified layers of fine sandy loam are in some places.

Kremlin soils are near Golva, Chinook, Chanta, and Boxwell soils. They contain more sand and less silt than Golva soils, and they contain more clay than Chinook soils. Kremlin soils lack the gravelly IIC horizon which Chanta soils have, and they are deeper than Boxwell soils.

KrB—Kremlin loam, 1 to 6 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are small areas of Boxwell, Golva, Chinook, Chanta, and Belfield soils on fans and terraces.

Runoff is medium. Water erosion is a moderate hazard. The main concerns of management are controlling erosion and conserving moisture.

Most areas of this soil are in native range. Capability unit IIIe–6; Silty range site.

KrC—Kremlin loam, 6 to 9 percent slopes. This soil is on fans and terraces. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Boxwell, Golva, Chinook, and Chanta soils on fans and terraces.

Runoff is medium. Water erosion is a moderate hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–6; Silty range site.

Lawther Series

The Lawther series consists of deep, well drained and moderately well drained, nearly level to gently sloping, fine textured soils on fans and uplands. These soils formed in alluvium.

In a representative profile the surface layer is dark grayish brown silty clay about 5 inches thick. The subsoil is about 26 inches thick. The upper part is dark grayish brown silty clay about 14 inches thick, and the lower part is gray calcareous silty clay about 12 inches thick. The underlying material is grayish brown calcareous silty clay.

Permeability is slow, and the available water capacity is high. Organic-matter content is moderate, and fertility is high.

Most areas of these soils are cultivated. They are suited to most crops commonly grown in the county.

Representative profile of Lawther silty clay, 1 to 3 percent slopes, in cropland, 175 feet east and 90 feet south of the northwestern corner of the northeast quarter of sec. 7, T. 136 N., R. 98 W.

Ap—0 to 5 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine granular structure; extremely hard, firm, very sticky and very plastic; mildly alkaline; abrupt smooth boundary.

B2—5 to 19 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse and medium prismatic structure parting to strong medium angular blocky; extremely hard, firm, very sticky and very plastic; moderately alkaline; gradual wavy boundary.

B3cs—19 to 31 inches; gray (N 5/0) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to strong coarse angular blocky; extremely hard, firm, very sticky and very plastic; few gypsum crystals; strong effervescence; moderately alkaline; gradual wavy boundary.

C1cs—31 to 39 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse and medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; many rounded masses of gypsum; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—39 to 60 inches; grayish brown (2.5Y 5/2) silty clay, olive gray (5Y 4/2) and dark grayish brown (2.5Y 4/2) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few small masses of gypsum; strong effervescence; moderately alkaline.

The A horizon is 4 to 10 inches thick. The B2 horizon is grayish brown, dark grayish brown, olive gray, or olive silty clay or clay.

Lawther soils are on a landscape similar to that of Grail, Moreau, Regent, and Savage soils. They are deeper than Regent and Moreau soils, and they have a thinner A horizon than Grail soils. Lawther soils have an Ap horizon of silty clay, unlike that of Savage soils.

LaA—Lawther silty clay, 1 to 3 percent slopes. This soil is on fans and uplands. It has the profile described as representative of the series.

Included with this soil in mapping are Moreau and Regent soils on uplands and Grail and Savage soils on fans and uplands.

Runoff is slow, and this soil is ponded briefly after heavy rain. Soil blowing is a slight hazard. Maintaining tilth and fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIs–4; Clayey range site.

LaB—Lawther silty clay, 3 to 6 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Regent and Moreau soils on uplands and Savage, Grail, and Belfield soils on fans and terraces.

Runoff is medium. Water erosion and soil blowing are moderate hazards. Controlling erosion and maintaining tilth are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–4; Clayey range site.

Lc—Lawther-Rhoades silty clays. This complex is on fans and uplands. The Lawther soil has a profile similar to the one described as representative of the series, but the surface layer is more dispersed and the lower part of the profile has a higher content of salt. The Rhoades soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay. There is a pitted microrelief in areas of the Rhoades soil. Slopes are 1 to 3 percent.

This complex is about 60 percent Lawther soils and 25 percent Rhoades soils. The rest is Daglum, Belfield, and Savage soils on fans and uplands.

Runoff is slow. Soil blowing is a moderate hazard. Salinity and alkalinity and the shallow root zone in the Rhoades soil are the main limitation. Controlling erosion and maintaining tilth are the main concerns of management.

Most areas of these soils are in crops. Capability unit IVs–4P; Lawther part in Clayey range site, Rhoades part in Thin Claypan range site.

Lawther Variant

The Lawther variant consists of deep, well drained, nearly level to moderately sloping, fine textured soils on fans and terraces. These soils formed in clayey alluvium that overlies sandy alluvium.

In a representative profile the surface layer is gray clay about 5 inches thick. The underlying material is gray clay about 21 inches thick, gray sandy clay loam about 6 inches thick, light brownish gray sandy loam about 4 inches thick, and, below that, light gray loamy coarse sand.

Permeability is slow above a depth of 36 inches and rapid below. The available water capacity is moderate. Organic-matter content is moderately low, and fertility is low.

Most areas of these soils are used for crops. Some areas are in native grass.

Representative profile of Lawther clay, sandy subsoil variant, 1 to 3 percent slopes, in cropland 390 feet north and 40 feet west of the southeastern corner of sec. 29, T. 134 N., R. 100 W.

Ap—0 to 5 inches; gray (5Y 5/1) clay, olive gray (5Y 5/2) moist; strong very fine granular structure; extremely hard, firm, very sticky and very plastic; slightly acid; abrupt smooth boundary.

C1—5 to 16 inches; gray (5Y 5/1) clay, olive gray (5Y 5/2) moist; strong fine angular blocky structure; extremely hard, firm, very sticky and very plastic; distinct slickensides; neutral; gradual wavy boundary.

C2—16 to 26 inches; gray (5Y 5/1) clay, olive

gray (5Y 5/2) moist; strong fine angular blocky structure; extremely hard, firm, very sticky and very plastic; distinct slickensides; slight effervescence; mildly alkaline; clear wavy boundary.

IIC3—26 to 32 inches; gray (5Y 5/1) sandy clay loam, very dark gray (5Y 3/1) moist; moderate medium angular blocky structure; very hard, friable, sticky and plastic; small masses of segregated lime in some pores and root channels; strong effervescence; mildly alkaline; clear wavy boundary.

IIIC4—32 to 36 inches; light brownish gray (2.5Y 6/2) sandy loam, grayish brown (2.5Y 5/2) moist; weak coarse prismatic structure; hard, very friable, slightly sticky and nonplastic; few fine gray (10YR 5/1) and dark gray (10YR 4/1) masses of segregated lime; slight effervescence; moderately alkaline; diffuse irregular boundary.

IIIC5—36 to 60 inches; light gray (2.5Y 7/2) loamy coarse sand, grayish brown (2.5Y 5/2) moist; massive parting to single grained; slightly hard, loose, nonsticky and nonplastic; slight effervescence; moderately alkaline.

The A horizon is gray or olive gray. The C horizon is gray, light gray, or light brownish gray. The IIC horizon is stratified sandy clay loam, sandy loam, loamy sand, loamy coarse sand, or coarse sand.

Lawther variant soils are near Mott and Rhoades soils. They contain more clay than Mott soils, and they lack the columnar structure of Rhoades soils.

LdA—Lawther clay, sandy subsoil variant, 1 to 3 percent slopes. This soil is on fans and terraces. It has the profile described as representative of the Lawther variant.

Included with this soil in mapping are Mott, Rhoades, and Absher soils on fans and terraces.

Runoff is medium. Soil blowing and water erosion are slight hazards. Controlling erosion, conserving moisture, and maintaining tilth are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIs–4; Clayey range site.

LdC—Lawther clay, sandy subsoil variant, 3 to 9 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the Lawther variant, but the surface layer is thinner.

Included with this soil in mapping are Mott soils on fans and terraces.

Runoff is medium. Soil blowing and water erosion are moderate hazards. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–4; Clayey range site.

Lefor Series

The Lefor series consists of moderately deep, well drained, nearly level to moderately sloping, moderately coarse textured soils on uplands. These soils formed in material weathered from shale and sandstone.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 15 inches thick. The upper part is brown fine sandy loam about 4 inches thick, and the lower part is light yellowish brown loam about 11 inches thick. The underlying material is pale olive calcareous clay loam about 11 inches thick and, below that, pale yellow soft sedimentary beds.

Permeability is moderate in the surface layer and upper part of the subsoil and moderately slow in the lower part of the subsoil and in the underlying material. The available water capacity is high. Organic-matter content is moderate, and fertility is medium.

These soils are well suited to small grain, corn, and grass. A few areas are in native grass.

Representative profile of Lefor fine sandy loam, in an area of Lefor-Vebar fine sandy loams, 6 to 9 percent slopes, in a cultivated field 1,060 feet west and 240 feet south of the northeastern corner of the northwest quarter of sec. 12, T. 134 N., R. 99 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; soft, very friable, nonsticky and nonplastic; slightly acid; clear smooth boundary.

B1—8 to 12 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable, slightly sticky and nonplastic; few thin clay films on peds; slightly acid; clear smooth boundary.

B2t—12 to 23 inches; light yellowish brown (2.5Y 6/4) loam, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films on peds; mildly alkaline; clear smooth boundary.

B3ca—23 to 34 inches; pale olive (5Y 6/3) clay loam, olive (5Y 5/3) moist; moderate coarse and medium subangular blocky structure; slightly hard, firm, sticky and slightly plastic; rounded medium sized soft masses of segregated lime; strong effervescence; moderately alkaline; clear smooth boundary.

C1—34 to 60 inches; pale yellow (5Y 7/3) soft sedimentary rock crushing to sandy clay loam, olive (5Y 5/3) moist; massive; slightly hard, friable, slightly sticky and nonplastic; strong effervescence; moderately alkaline.

The A horizon is dark grayish brown, grayish brown, or brown. The B2t horizon is sandy loam, fine sandy loam, loam, or sandy clay loam.

Lefor soils are on a landscape similar to that of Vebar, Parshall, and Reeder soils. They are not so deep as Parshall soils. Unlike Vebar soils, Lefor soils have

a Bt horizon. Unlike Reeder soils, their A horizon is fine sandy loam.

LeB—Lefor-Vebar fine sandy loams, 1 to 6 percent slopes. This complex is on uplands. The soils have a profile similar to the one described as representative of their series, but the surface layer is thicker.

This complex consists of about 60 percent Lefor soils and 25 percent Vebar soils. The rest is Parshall and Reeder soils on uplands.

Runoff is medium. Soil blowing is a serious hazard, and water erosion is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIIe–3; Sandy range site.

LeC—Lefor-Vebar fine sandy loams, 6 to 9 percent slopes. This complex is on uplands. The Lefor soil has the profile described as representative of the series.

This complex consists of about 55 percent Lefor soils and 30 percent Vebar soils. The rest is Flasher and Parshall soils on uplands.

Runoff is medium. Soil blowing and water erosion are serious hazards. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IVe–3; Sandy range site.

Lihen Series

The Lihen series consists of deep, well drained, nearly level to moderately sloping, coarse textured soils on terraces and uplands. These soils formed in alluvium and wind-deposited materials.

In a representative profile the surface layer is dark grayish brown loamy fine sand about 27 inches thick. The underlying material is grayish brown loamy fine sand about 16 inches thick and, below that, light brownish gray calcareous loamy fine sand.

Permeability is rapid, and the available water capacity is low to moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used for crops and pasture.

Representative profile of Lihen loamy fine sand, in an area of Telfer-Lihen loamy fine sands, 6 to 9 percent slopes, in cropland 590 feet west and 370 feet north of the southeastern corner of the southwest quarter of sec. 28, T. 136 N., R. 98 W.

Ap—0 to 5 inches; dark grayish brown (2.5Y 4/2) loamy fine sand, very dark grayish brown (2.5Y 3/2) moist; weak medium and fine granular structure; loose, very friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

A12—5 to 27 inches; dark grayish brown (2.5Y 4/2) loamy fine sand, very dark grayish brown (2.5Y 3/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; loose, very friable, nonsticky and nonplastic; neutral; gradual smooth boundary.

AC—27 to 37 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, very friable, nonsticky and nonplastic; neutral; gradual wavy boundary.

C1—37 to 43 inches; grayish brown (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, very friable, nonsticky and nonplastic; neutral; gradual wavy boundary.

C2ca—43 to 60 inches; light brownish gray (2.5Y 6/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; single grained; loose, very friable, nonsticky and nonplastic; many small soft masses of lime; strong effervescence; mildly alkaline.

The A horizon is dark grayish brown or dark brown. The C horizon is loamy sand or loamy fine sand. In some places the substratum is finer textured below a depth of 40 inches.

Lihen soils are on a landscape similar to that of Telfer, Vebar, and Tally soils. They are deeper than Vebar soils, and they have a thicker A horizon than Telfer and Tally soils.

Lihen soils are mapped only in complex with Telfer soils.

Manning Series

The Manning series consists of moderately deep over sand and gravel, somewhat excessively drained, nearly level to moderately sloping, moderately coarse textured soils on terraces. These soils formed in alluvium.

In a representative profile the surface layer is brown fine sandy loam about 5 inches thick. The subsoil is about 22 inches thick. The upper part is brown fine sandy loam about 13 inches thick, and the lower part is light brownish gray loam about 9 inches thick. The underlying material is light brownish gray calcareous loam about 6 inches thick, light olive brown gravel about 12 inches thick, and, below that, pale yellow sand.

Permeability is moderately rapid above the gravel layer and very rapid below that. The available water capacity is low. Organic-matter content is moderate, and fertility is medium.

These soils are suited to cultivated crops and grass.

Representative profile of Manning fine sandy loam, 1 to 3 percent slopes, in a cultivated field 120 feet south and 140 feet east of the northwestern corner of the northeast quarter of sec. 19, T. 135 N., R. 99 W.

Ap—0 to 5 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.

B21—5 to 18 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, friable, nonsticky and nonplastic; neutral; clear wavy boundary.

B22—18 to 27 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; medium sized soft masses of segregated lime; slight

effervescence; mildly alkaline; gradual wavy boundary.

C1ca—27 to 33 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; medium sized soft masses of segregated lime; strong effervescence; mildly alkaline; gradual wavy boundary.

IIC2—33 to 45 inches; light olive brown (2.5Y 5/4) gravel, olive brown (2.5Y 4/4) moist; single grained; loose, nonsticky and nonplastic; lime coatings on bottom of gravel; slight effervescence; mildly alkaline; clear smooth boundary.

IIC3—45 to 60 inches; pale yellow (5Y 7/3) sand, pale olive (5Y 6/3) moist; single grained; loose, nonsticky and nonplastic; medium sized soft masses of lime; slight effervescence; mildly alkaline.

The A horizon is 4 to 7 inches thick. The B2 horizon is brown, light brownish gray, grayish brown, or dark grayish brown sandy loam, loam, or fine sandy loam.

Manning soils are on a landscape similar to that of Stady, Tally, Parshall, and Wabek soils. They contain less clay than Stady soils, and they are deeper to gravel than Wabek soils. Unlike Tally and Parshall soils, Manning soils have a gravelly IIC horizon.

MaA—Manning fine sandy loam, 1 to 3 percent slopes. This soil is on terraces. It has the profile described as representative of the series.

Included with this soil in mapping are Parshall soils on terraces.

Runoff is slow. Soil blowing is a moderate hazard. Conserving moisture and controlling erosion are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–3; Sandy range site.

MaB—Manning fine sandy loam, 3 to 6 percent slopes. This soil is on terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Parshall, Tally, and Wabek soils on terraces.

Runoff is slow. Soil blowing is a serious hazard. Conserving moisture and controlling erosion are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–3; Sandy range site.

McKenzie Series

The McKenzie series consists of deep, poorly drained, level, fine textured soils in depressions and lake basins. These soils formed in clayey sediment.

In a representative profile the surface layer is gray clay about 3 inches thick. The underlying material is gray calcareous clay about 21 inches thick, gray and light gray calcareous clay about 20 inches thick, and below that, light olive gray calcareous clay.

Permeability is very slow, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used for grazing and hay.

Representative profile of McKenzie clay, in an area of Heil and McKenzie soils, in native grass 0.3 mile south and 0.2 mile east of the northwestern corner of sec. 2, T. 136 N., R. 99 W.

A1—0 to 3 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak fine angular blocky structure; extremely hard, very firm, very sticky and very plastic; light gray (5Y 6/1) crust on the surface; slight effervescence; strongly alkaline; gradual wavy boundary.

C1—3 to 24 inches; gray (5Y 6/1) clay, dark gray (5Y 4/1) moist; massive; extremely hard, very firm, very sticky and plastic; strong effervescence; strongly alkaline; diffuse irregular boundary.

C2—24 to 44 inches; gray and light gray (5Y 5/1 and 6/1) clay, dark gray (5Y 4/1) moist; massive; extremely hard, very firm, very sticky and plastic; few slickensides; strong effervescence; strongly alkaline; gradual wavy boundary.

C3—44 to 60 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 4/2) moist; few fine brown (10YR 5/3) mottles; massive; extremely hard, very firm, very sticky and plastic; strong effervescence; strongly alkaline.

Reaction ranges from moderately alkaline to strongly alkaline. Yellow or brown mottles are below a depth of 24 inches in some places.

McKenzie soils are on a landscape similar to that of Heil and Dimmick soils. They lack the columnar structure which Heil soils have, and they are better drained than Dimmick soils.

McKenzie soils are mapped only with Heil soils.

Moreau Series

The Moreau series consists of moderately deep, well drained, nearly level to moderately sloping, fine textured soils on uplands. These soils formed in weathered soft shale.

In a representative profile the surface layer is grayish brown silty clay about 6 inches thick. The subsoil is 15 inches thick. The upper part is grayish brown calcareous silty clay about 6 inches thick, and the lower part is light yellowish brown calcareous silty clay about 9 inches thick. The underlying material is light olive gray calcareous silty clay about 8 inches thick and, below that, light olive gray calcareous soft shale.

Permeability is slow, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are suited to most crops grown in the county. They are not well suited to corn.

Representative profile of Moreau silty clay, 1 to 3 percent slopes, in cropland, 130 feet east and 25 feet north of the southwest corner of the northwest quarter of sec. 9, T. 133 N., R. 99 W.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure parting to moderate very fine granular; very hard, friable, sticky and

plastic; slight effervescence; moderately alkaline; abrupt smooth boundary.

B21—6 to 12 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown and very dark grayish brown (2.5Y 4/2 and 3/2) moist; weak coarse prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

B22—12 to 21 inches; light yellowish brown (2.5Y 6/3) silty clay, olive brown (2.5Y 4/3) moist; weak coarse prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; few fine gypsum crystals; few soft yellowish brown (10YR 5/4) iron stains; strong effervescence; moderately alkaline; clear wavy boundary.

C1—21 to 29 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 4/2) moist; weak coarse subangular blocky structure parting to weak thick platy; very hard, firm, sticky and plastic; few fine gypsum crystals; strong effervescence; moderately alkaline; clear wavy boundary.

C2—29 to 60 inches; light olive gray (5Y 6/2) soft platy shale crushing to silty clay; common gypsum crystals; strong effervescence; moderately alkaline.

The A horizon is grayish brown or dark grayish brown. The B2 horizon is olive gray, grayish brown, light brownish gray, or light yellowish brown clay or silty clay.

Moreau soils are on a landscape similar to that of Regent, Lawther, Wayden, and Rhoades soils. They lack the Cca horizon which Regent soils have, and they are not so deep as Lawther soils. Moreau soils are deeper than Wayden soils, and they lack the columnar structure and high sodium content which Rhoades soils have.

MeA—Moreau silty clay, 1 to 3 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Regent, Lawther, and Rhoades soils on uplands.

Runoff is medium. Soil blowing is a serious hazard. Maintaining tilth and controlling erosion are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIs–4L; Clayey range site.

MeB—Moreau silty clay, 3 to 6 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Regent, Lawther, and Rhoades soils on uplands.

Runoff is medium. Soil blowing and water erosion are severe hazards. Controlling erosion and maintaining tilth are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–4L; Clayey range site.

MeC—Moreau silty clay, 6 to 9 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Regent, Cabba, Lawther, Rhoades, and Wayden soils on uplands.

Runoff is rapid. Water erosion and soil blowing are severe hazards. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IVe–4L; Clayey range site.

Morton Series

The Morton series consists of moderately deep, well drained, nearly level to moderately sloping soils on uplands. These soils are medium textured and moderately fine textured. They formed in soft shale.

In a representative profile the surface layer is grayish brown silt loam about 8 inches thick. The subsoil is about 24 inches thick. The upper part is grayish brown silty clay loam about 16 inches thick, and the lower part is pale yellow calcareous silty clay loam. The underlying material is pale yellow calcareous silty clay loam about 4 inches thick and, below that, soft shale.

Permeability is moderate in the surface layer and subsoil and moderately slow below that. The available water capacity is moderate to high. The organic-matter content is moderate, and fertility is high.

Most areas of these soils are used for crops. They are suited to all crops grown in the county.

Representative profile of Morton silt loam, 1 to 3 percent slopes, in cropland 1,060 feet south and 150 feet west of the northeastern corner of the southeast quarter of sec. 23, T. 136 N., R. 99 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A12—6 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B21t—8 to 14 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; thin patchy clay films on peds; neutral; clear wavy boundary.

B22t—14 to 24 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; strong coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; thin patchy clay films on ped faces; neutral; clear wavy boundary.

B3ca—24 to 32 inches; pale yellow (2.5Y 7/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure; hard, friable, sticky and plastic; fine

soft masses of segregated lime; slight effervescence; mildly alkaline; clear wavy boundary.

C1ca—32 to 36 inches; pale yellow (2.5Y 7/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak fine subangular blocky structure; very hard, friable, sticky and plastic; fine soft masses of segregated lime; strong effervescence; mildly alkaline; clear wavy boundary.

C2—36 to 60 inches; pale yellow (2.5Y 7/4) soft shale beds that crush to silt loam, light olive brown (2.5Y 5/4) moist; many fine distinct yellowish brown (10YR 5/8) mottles; massive; very hard, friable slightly sticky and slightly plastic, many gypsum crystals; slight effervescence; mildly alkaline.

The A horizon is grayish brown, dark grayish brown, or dark brown silt loam or silty clay loam. The B2t horizon is grayish brown, light brownish gray, dark grayish brown, or brown silty clay loam or clay loam.

Morton soils are on a landscape similar to that of Golva, Grassna, Reeder, and Sen soils. Morton soils are not so deep as Golva and Grassna soils, and they contain more silt and less sand than Reeder soils. Unlike Sen soils, they have a Bt horizon.

MoA—Morton silt loam, 1 to 3 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are Chama, Sen, and Amor soils on uplands and Grassna soils in swales and on fans and foot slopes.

Runoff is medium. Conserving moisture and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIc–6; Silty range site.

MoB—Morton silt loam, 3 to 6 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Cabba, Chama, Sen, and Vebar soils on uplands and Arnegard and Grail soils in swales and on fans and foot slopes.

Runoff is medium to rapid. Soil blowing and water erosion are slight hazards. Conserving moisture and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

MoC—Morton silt loam, 6 to 9 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Cabba, Chama, Sen, Regent, and Vebar soils on uplands.

Runoff is rapid. Soil blowing and water erosion are moderate hazards. Controlling erosion, maintaining fertility, and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6; Silty range site.

MpA—Morton complex, 1 to 3 percent slopes. These soils are on uplands. The Morton soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. This complex consists of about 50 percent Morton soil. The rest is Regent, Sen, Cabba, Grassna, Grail, and Belfield soils.

Runoff is medium. Maintaining fertility is the main concern of management.

Most areas of these soils are cultivated. Capability unit IIc–6; Silty range site.

MpB—Morton complex, 3 to 6 percent slopes. These soils are on uplands. The Morton soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. This complex consists of about 55 percent Morton soil. The rest is Regent, Sen, Cabba, Chama, Arnegard, Grail, and Belfield soils.

Runoff is medium. Soil blowing and water erosion are slight problems. Conserving moisture and maintaining fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIe–6; Silty range site.

MpC—Morton complex, 6 to 9 percent slopes. These soils are on uplands. The Morton soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. This complex consists of about 45 percent Morton soil. The rest is Regent, Sen, Cabba, Chama, Amor, and Grail soils.

Runoff is medium. Soil blowing and water erosion are moderate hazards. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIIe–6; Silty range site.

MrB—Morton-Rhoades silt loams, 3 to 6 percent slopes. This complex is on uplands. The Morton soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Rhoades soil has a profile similar to the one described as representative of the Rhoades series, but the surface layer is silt loam.

This complex consists of about 75 percent Morton soil and 20 percent Rhoades soil. The rest is Morton and Rhoades soils that have slopes of 1 to 3 percent.

Runoff is medium. Soil blowing is a moderate hazard. Salinity and alkalinity and the shallow root zone in the Rhoades soil are the main limitations. Maintaining tilth and fertility and controlling erosion are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIIs–6P; Morton part in Silty range site, Rhoades part in Thin Claypan range site.

MrC—Morton-Rhoades silt loams, 6 to 9 percent slopes. This complex is on uplands. The Morton soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Rhoades soil has a profile similar to the one described as representative of the Rhoades series, but the surface layer is silt loam. This complex consists of 70 percent Morton soil and 15 percent Rhoades soil.

Included with these soils in mapping are small areas of Sen, Cabba, and Belfield soils.

Runoff is rapid. Soil blowing and water erosion are moderate hazards. Salinity and alkalinity and the poor tilth of the Rhoades soil are the main limitations. Controlling erosion and maintaining tilth are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IVs–6P; Morton part in Silty range site, Rhoades part in Thin Claypan range site.

Mott Series

The Mott series consists of deep, well drained, nearly level to gently sloping, moderately coarse textured and medium textured soils on fans and terraces. These soils formed in alluvium.

In a representative profile the surface layer is grayish brown sandy loam about 6 inches thick. The subsoil is about 13 inches thick. The upper part is brown sandy loam about 7 inches thick, and the lower part is very pale brown fine sandy loam 6 inches thick. The underlying material is light gray fine sandy loam about 16 inches thick, light brownish gray fine sandy loam about 11 inches thick, and, below that, light gray loamy coarse sand.

Permeability is moderately rapid or rapid. The available water capacity is moderate. Organic-matter content and fertility are low.

These soils are used for small grain, hay, and pasture.

Representative profile of Mott sandy loam, 1 to 3 percent slopes, in a cultivated field 1,000 feet south and 155 feet west of the northeastern corner of sec. 24, T. 134 N., R. 101 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular structure; hard, very friable, slightly sticky and slightly plastic; medium acid; abrupt smooth boundary.

B21—6 to 13 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; clay coatings on sand grains; slightly acid; clear wavy boundary.

B22—13 to 19 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; clay coatings on sand grains; neutral; clear wavy boundary.

C1—19 to 25 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; clay coatings on sand grains; neutral; gradual smooth boundary.

C2—25 to 33 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; moderate medium subangular structure; slightly hard, very friable, slightly sticky and slightly plastic; clay coatings on sand grains; neutral; clear wavy boundary.

IIC3—33 to 35 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; moderate medium subangular blocky structure; hard, friable, sticky and slightly plastic; neutral; abrupt smooth boundary.

IIIC4—35 to 46 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; gradual wavy boundary.

IVC5—46 to 60 inches; light gray (2.5Y 7/2) loamy coarse sand, grayish brown (2.5Y 5/2) moist; massive parting to single grained; slightly hard, loose, slightly sticky and nonplastic; slight effervescence; mildly alkaline.

The A horizon is grayish brown or dark grayish brown loam or sandy loam. The B2 horizon is grayish brown, light brownish gray, very pale brown, light gray, or brown sandy loam, coarse sandy loam, or loam.

Mott soils are on a landscape similar to that of Amor, Belfield, Daglum, and Rhoades soils. They contain less clay and are deeper than Amor soils. Mott soils contain less clay than Belfield, Daglum, and Rhoades soils, and they lack the high content of sodium which these soils have.

MsA—Mott sandy loam, 1 to 3 percent slopes. This soil is on fans and terraces. It has the profile described as representative of the series.

Included with this soil in mapping are Mott soils that have a surface layer of loam, Rhoades soils, and Ekalaka soils on fans and terraces and soils that have a surface layer of sand or loamy sand.

Runoff is medium. Soil blowing is a serious hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–3; Sandy range site.

MsB—Mott sandy loam, 3 to 6 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Rhoades and Ekalaka soils on fans and terraces and Mott soils that have a surface layer of sand or loamy sand.

Runoff is medium. Water erosion and soil blowing are moderate hazards. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–3; Sandy range site.

MtA—Mott loam, 1 to 3 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is loam.

Included with this soil in mapping are areas of Mott soils that have a surface layer of sandy loam or silty clay loam and Rhoades and Ekalaka soils on fans and terraces.

Runoff is medium. Water erosion is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIe–6; Silty range site.

MtB—Mott loam, 3 to 6 percent slopes. This soil is on fans and terraces. It has a profile similar to the one

described as representative of the series, but the surface layer is loam.

Included with this soil in mapping are areas of Mott soils that have a surface layer of sandy loam or silty clay loam and Rhoades and Ekalaka soils on fans and terraces.

Runoff is medium. Water erosion is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIe–6; Silty range site.

Parshall Series

The Parshall series consists of deep, well drained, nearly level to gently sloping, moderately coarse textured soils in swales, shallow depressions, and intermittent drainageways. These soils formed in material that was washed from adjacent uplands.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is dark grayish brown fine sandy loam about 25 inches thick. The underlying material is light brownish gray calcareous fine sandy loam about 13 inches thick and, below that, brownish gray calcareous loamy fine sand.

Permeability is moderately rapid, and the available water capacity is moderate. Organic-matter content and fertility are high.

Almost all areas of these soils are cultivated. A few are in native grass. These soils are suited to all cultivated crops grown in the county.

Representative profile of Parshall fine sandy loam, 1 to 6 percent slopes, in native range 540 feet west and 830 feet north of the southeastern corner of the southwest quarter of sec. 15, T. 136 N., R. 98 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B2—8 to 33 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable, slightly sticky and nonplastic; neutral; gradual wavy boundary.

C1ca—33 to 46 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence; mildly alkaline; diffuse wavy boundary.

C2ca—46 to 60 inches; brownish gray (2.5Y 5/2) loamy fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; soft, very friable, nonsticky and nonplastic; violent effervescence; mildly alkaline.

The A horizon is dark grayish brown. The B2 horizon is dark grayish brown, dark brown, or brown. The C horizon is sandy loam or loamy fine sand. In some places the substratum is gravelly below a depth of 40 inches.

Parshall soils are on a landscape similar to that of Vebar and Tally soils. They are deeper than Vebar soils, and they have a thicker B horizon than Tally soils.

PaB—Parshall fine sandy loam, 1 to 6 percent slopes. This soil is in swales, shallow depressions, and intermittent drainageways. It has the profile described as representative of the series.

Included with this soil in mapping are Parshall soils that have slopes of 6 to 9 percent and Tally soils in similar positions on the landscape.

Runoff is slow. Soil blowing is a serious hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–3; Sandy range site.

Patent Series

The Patent series consists of deep, well drained, gently sloping to strongly sloping, medium textured soils on fans and foot slopes. These soils formed in material that was washed from adjacent uplands.

In a representative profile the surface layer is grayish brown loam about 4 inches thick. The underlying material is light brownish gray loam about 16 inches thick and, below that, light brownish gray calcareous loam.

Permeability and the available water capacity are moderate. Organic-matter content is moderately low, and fertility is medium.

These soils are used mainly for native range. In a few areas they are cultivated or used for hay.

Representative profile of Patent loam, 6 to 15 percent slopes, in native range 800 feet east and 300 feet south of the northwestern corner of the southwest quarter of sec. 10, T. 135 N., R. 105 W.

A1—0 to 4 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and fine granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; abrupt smooth boundary.

C1—4 to 20 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate thick platy; soft, friable, slightly sticky and slightly plastic; few thin strata of fine sandy loam; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—20 to 27 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular structure parting to weak thick platy; hard, friable, slightly sticky and nonplastic; few small masses of lime; few thin strata of fine sandy loam; slight effervescence; moderately alkaline; clear wavy boundary.

C3—27 to 31 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak very coarse prismatic

structure parting to weak thick and thin platy; hard, friable, slightly sticky and nonplastic; few small masses of lime; few thin strata of fine sandy loam; slight effervescence; moderately alkaline; gradual wavy boundary.

C4—31 to 60 inches, light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; slight effervescence; moderately alkaline.

The A horizon is grayish brown, light brownish gray, or light gray. The A horizon is calcareous in some places. Buried horizons are in some places.

Patent soils are near Cabba, Cherry, and Sham soils. They are deeper than Cabba soils, and they contain more sand and less silt than Cherry soils. Patent soils contain more clay than Sham soils.

PeB—Patent loam, 3 to 6 percent slopes. This soil is on fans and foot slopes. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are Patent soils that have slopes of 1 to 3 percent; Cherry, Sham, and Absher soils on fans and foot slopes; and Cabba soils on uplands.

Runoff is medium. Water erosion is a hazard in places where runoff concentrates. Controlling erosion and maintaining a good grass cover are the main concerns of management.

Most areas of this soil are in native range. Capability unit IIIe–4L; Silty range site.

PeD—Patent loam, 6 to 15 percent slopes. This soil is on fans and foot slopes. It has the profile described as representative of the series.

Included with this soil in mapping are Cabba soils on uplands and Cherry soils on fans and foot slopes.

Runoff is medium to rapid. Water erosion and soil blowing are severe hazards. Controlling erosion and proper range use are the main concerns of management.

This soil is used mainly for native range. Capability unit VIe (Silty); Silty range site.

PsD–Patent-Sham-Gullied land complex, 3 to 15 percent slopes. This complex is on fans and terraces that are undergoing geologic erosion (fig. 10). Gullies that are 2 to 20 feet deep and 3 to 15 feet wide dissect about 15 percent or more of the mapped areas. Sediment from eroding uplands is deposited in spring and after heavy rain.

This complex consists of about 25 percent Patent soils, 25 percent Sham soils, and 15 percent Gullied

Figure 10.—An area of Patent-Sham-Gullied land complex, 3 to 15 percent slopes. The soils in this complex are suited to native rangeland.

land. The rest is Kremlin and Glendive soils on fans and terraces.

Runoff is rapid. Erosion is a severe hazard. Proper range use to maintain a good grass cover is the main concern of management.

All areas of this mapping unit are in native range. Capability unit VIIe (Silty); Patent part in Silty range site, Sham part in Claypan range site, Gullied land part not assigned to a range site.

Reeder Series

The Reeder series consists of moderately deep, well drained, nearly level to moderately sloping, medium textured soils on uplands. These soils formed in material weathered from sandstone or shale.

In a representative profile the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown clay loam about 7 inches thick, the middle part is brown clay loam about 8 inches thick, and the lower part is pale olive loam about 3 inches thick. The underlying material is pale yellow calcareous loam about 12 inches thick and, below that, light gray soft sandstone.

Permeability is moderate, and the available water capacity is high. Organic-matter content is moderate, and fertility is high.

These soils are used mainly for crops. In some areas they are in native range. These soils are well suited to cultivated crops, grass, and trees.

Representative profile of Reeder loam, 3 to 6 percent slopes, in a cultivated area 80 feet south and 470 feet east of the northwestern corner of sec. 1, T. 134 N., R. 99 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B21t—8 to 15 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slight hard, friable, slightly sticky and slightly plastic; thin clay films on faces of peds; neutral; clear wavy boundary.

B22t—15 to 23 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and slightly plastic; continuous thin clay films on faces of peds; neutral; gradual wavy boundary.

B3—23 to 26 inches; pale olive (5Y 6/3) loam, olive (5Y 5/3) moist; weak fine prismatic structure parting to moderate medium subangular blocky; slightly hard, firm, slightly sticky and nonplastic; few iron concretions; neutral; gradual wavy boundary.

C1—26 to 38 inches; pale yellow (5Y 7/3 and 7/4) loam, olive (5Y 5/3) and light olive brown (2.5Y 5/4) moist; weak coarse and medium subangular blocky structure; slightly hard, firm, slightly sticky and nonplastic; slight effervescence; mildly alkaline; gradual wavy boundary.

C2—38 to 60 inches; light gray (5Y 7/2) soft sandstone crushing to fine sandy loam, olive gray (5Y 5/2) moist; few small masses of lime; slight effervescence; mildly alkaline.

The A horizon is dark grayish brown, grayish brown, or very dark grayish brown. The B2t horizon is brown, dark grayish brown, or grayish brown.

Reeder soils are on a landscape similar to that of Amor, Morton, Sen, Shambo, and Cabba soils. They are deeper than Cabba soils, but they are not so deep as Shambo soils. Unlike Amor and Sen soils, Reeder soils have a Bt horizon. Reeder soils contain more sand and less silt than Morton soils.

ReA—Reeder loam, 1 to 3 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are Grassna soils in swales and Amor soils on uplands.

Runoff is medium. Conserving moisture and maintaining organic-matter content and fertility are the main concerns of management.

Almost all areas of this soil are cultivated. Capability unit IIc–6; Silty range site.

ReB—Reeder loam, 3 to 6 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are Amor, Morton, and Vebar soils on uplands that make up about 25 percent of the mapping unit.

Runoff is medium. Soil blowing and water erosion are slight hazards. Conserving moisture and maintaining fertility are the main concerns of management.

Almost all areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

ReC—Reeder loam, 6 to 9 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are small areas of Amor, Morton, Vebar, Chama, and Cabba soils on uplands.

Runoff is medium to rapid. Soil blowing and water erosion are moderate hazards. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6; Silty range site.

Regent Series

The Regent series consists of moderately deep, well drained, nearly level to moderately sloping, moderately fine textured soils on uplands. These soils formed in soft shale.

In a representative profile the surface layer is grayish brown silty clay loam about 6 inches thick. The subsoil is grayish brown silty clay about 8 inches thick.

The underlying material is light gray calcareous silty clay and light gray weathered soft shale.

Permeability is slow, and the available water capacity is high. Organic-matter content is moderate, and fertility is medium.

Almost all areas of these soils are used for crops. Some areas are in native range. These soils are suited to all crops commonly grown in the county.

Representative profile of Regent silty clay loam, 3 to 6 percent slopes, in a cultivated field 410 feet south and 270 feet west of the northeastern corner of sec. 9, T. 135 N., R. 99 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; slightly hard, firm, sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

B2t—6 to 14 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to strong coarse and medium angular blocky; hard, very firm, very sticky and plastic; slight effervescence; mildly alkaline; common thin clay films on peds; clear wavy boundary.

C1ca—14 to 36 inches; light gray (5Y 6/1 and N 7/0) silty clay, gray (5Y 5/1) moist; moderate medium angular blocky structure; hard, firm, very sticky and plastic; strong effervescence; moderately alkaline; few fine ironstone concretions; strong effervescence; moderately alkaline; clear wavy boundary.

C2—36 to 43 inches; light gray (5Y 6/1) silty clay and soft shale, gray (5Y 5/1) moist; massive; hard, firm, very sticky and very plastic; medium sized soft masses of segregated lime; slight effervescence; moderately alkaline; diffuse irregular boundary.

C3—43 to 60 inches; light gray (5Y 7/1) silty clay and soft shale, gray (5Y 5/1) and grayish brown (2.5Y 5/2) moist; massive; hard, firm, very sticky and plastic; moderately alkaline.

The A horizon is dark grayish brown or grayish brown. The B2t horizon is grayish brown, light brownish gray, or light olive brown. It is silty clay loam, clay loam, or silty clay.

Regent soils are near Grail, Lawther, Moreau, Morton, and Rhoades soils. They are not so deep as Grail and Lawther soils, and they contain more clay than Morton soils. Regent soils lack the columnar structure and high content of sodium which Rhoades soils have. Unlike Moreau soils, Regent soils have a Bt horizon.

RgA—Regent silty clay loam, 1 to 3 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are Morton, Moreau, Grail, Cabba, and Belfield soils on uplands.

Runoff is slow to medium. Conserving moisture and maintaining organic-matter content and fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIc–7; Clayey range site.

RgB—Regent silty clay loam, 3 to 6 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are Morton, Moreau, Cabba, and Belfield soils on uplands.

Runoff is medium. Soil blowing and water erosion are slight hazards. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIe–7; Clayey range site.

RhA—Regent-Rhoades silty clay loams, 1 to 3 percent slopes. This complex is on uplands. The Rhoades soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. There is a pitted microrelief in areas of the Rhoades soil. This complex consists of about 75 percent Regent soil and 20 percent Rhoades soil.

Runoff is slow. Salinity and alkalinity and the shallow root zone in the Rhoades soil are the main limitations to the use of these soils. Maintaining tilth and fertility is the main concern of management.

Most areas of this soil are cultivated. Capability unit IIIs–7P; Regent part in Clayey range site, Rhoades part in Thin Claypan range site.

RhC—Regent-Rhoades silty clay loams, 3 to 9 percent slopes. This complex is on uplands. The Regent soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Rhoades soil has a profile similar to the one described as representative of the series, but the surface layer is silty clay loam. There is a pitted microrelief in areas of the Rhoades soil. This complex is about 75 percent Regent soil and 20 percent Rhoades soil.

Runoff is medium to rapid. Soil blowing and water erosion are moderate hazards. Salinity and alkalinity and the shallow root zone in the Rhoades soil are the chief limitations. Controlling erosion and maintaining tilth and fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIIe–7P; Regent part in Clayey range site, Rhoades part in Thin Claypan range site.

Rhame Series

The Rhame series consists of moderately deep, well drained, gently sloping to strongly sloping, moderately coarse textured soils on uplands. These soils formed in material weathered from soft sandstone.

In a representative profile the surface layer is grayish brown fine sandy loam about 5 inches thick. The subsoil is about 24 inches thick. The upper part is grayish brown fine sandy loam about 10 inches thick, and the lower part is light brownish gray fine sandy loam about 14 inches thick. The underlying material is light gray calcareous fine sandy loam about 6 inches thick, pale olive calcareous soft sandstone about 7 inches thick, and below that, light gray and pale yellow soft sandstone.

Permeability is moderately rapid, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used for range and cultivated crops. They are suited to crops commonly grown in the county.

Representative profile of Rhame fine sandy loam, in an area of Rhame-Chinook fine sandy loams, 6 to 9 percent slopes, in native range 630 feet north and 180 feet east of the southwestern corner of sec. 27, T. 133 N., R. 106 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B2—5 to 15 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; slightly sticky and nonplastic; neutral; gradual wavy boundary.

B3—15 to 29 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

C1—29 to 35 inches; light gray (2.5Y 7/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many threads of segregated lime; strong effervescence; moderately alkaline; clear wavy boundary.

C2—35 to 42 inches; pale olive (5Y 6/3) soft sandstone crushing to fine sandy loam, olive (5Y 4/3) moist; hard, firm, slightly sticky and slightly plastic; small soft masses of segregated lime; strong effervescence; mildly alkaline; clear wavy boundary.

C3—42 to 60 inches; light gray and pale yellow (5Y 7/2 and 7/3) soft bedded sandstone that crushes to loamy fine sand, olive gray and olive (5Y 5/2 and 5/3) moist; soft, friable, nonsticky and nonplastic; slight effervescence in the upper part; mildly alkaline.

The B2 horizon is grayish brown, light brownish gray, light yellowish brown, or pale brown.

Rhame soils are near Fleak and Chinook soils. They are deeper than Fleak soils, and they are not so deep as Chinook soils.

RkB—Rhame-Chinook fine sandy loams, 3 to 6 percent slopes. This complex is on uplands. The Rhame soil has a profile similar to the one described as representative of the series, but the surface layer is thicker. The Chinook soil has the profile described as representative of the series. This complex consists of about 55 percent Rhame soil and 45 percent Chinook soil.

Included with these soils in mapping are small areas of Kremlin and Fleak soils.

Runoff is slow to medium. Soil blowing is a severe hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of these soils are in native range. Capability unit IIIe–3; Sandy range site.

RkC–Rhame-Chinook fine sandy loams, 6 to 9 percent slopes. This complex is on uplands. The Rhame soil has the profile described as representative of the series. The Chinook soil has a profile similar to the one described as representative of the series, but the surface layer is thinner.

This complex is about 45 percent Rhame soil and 35 percent Chinook soil. The rest is Kremlin and Fleak soils on uplands.

Runoff is slow to medium. Soil blowing is a serious hazard. Controlling erosion and conserving moisture are the main concerns of management.

Almost all areas of these soils are in native range. Capability unit IVe–3; Sandy range site.

RmC—Rhame-Fleak fine sandy loams, 6 to 9 percent slopes. This complex is on uplands. The Rhame soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Fleak soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam.

This complex is about 55 percent Rhame soil and 35 percent Fleak soil. The rest is Chinook, Kremlin, Chanta, and Zeona soils on terraces and fans.

Runoff is medium. Soil blowing is a severe hazard. Controlling erosion and conserving moisture are the main concerns of management.

Almost all areas of these soils are in native range. Capability unit IVe–3; Rhame part in Sandy range site, Fleak part in Shallow range site.

RmD—Rhame-Fleak fine sandy loams, 9 to 15 percent slopes. This complex is on uplands. The Rhame soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Fleak soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam. This complex consists of about 55 percent Rhame soil and 35 percent Fleak soil.

Included with these soils in mapping are small areas of Chinook, Kremlin, Chanta, and Zeona soils.

Runoff is medium. Soil blowing is a severe hazard. Control of erosion, conservation of moisture, and maintaining a good grass cover are the main concerns of management.

Almost all areas of these soils are in native range. Capability unit VIe (Sandy); Rhame part in Sandy range site, Fleak part in Shallow range site.

Rhoades Series

The Rhoades series consists of deep, moderately well drained, nearly level to moderately sloping, medium textured, moderately fine textured, and fine textured soil on uplands, terraces, and fans. These soils formed in alluvium and in material weathered from shale.

In a representative profile the surface layer is grayish brown loam about 3 inches thick. The subsoil is 27 inches thick. The upper part is dark grayish brown silty clay loam about 10 inches thick, the middle part is grayish brown silty clay loam about 5 inches thick, and the lower part is grayish brown calcareous silty

clay loam about 12 inches thick. The underlying material is light olive gray calcareous silty clay loam about 12 inches thick, light gray and pale yellow silty clay about 11 inches thick, and below that, pale yellow soft shale.

Permeability is very low, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is low.

These soils are mostly in range or pasture. In some small areas they are cultivated. These soils are not well suited to cultivated crops.

Representative profile of Rhoades loam, in an area of Rhoades complex, 1 to 6 percent slopes, in native range 880 feet north and 175 feet east of the southwestern corner of sec. 12, T. 136 N., R. 100 W.

A2—0 to 3 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium platy structure; slightly hard, friable, slightly sticky and nonplastic; neutral; abrupt smooth boundary.

B21t—3 to 13 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong coarse columnar structure parting to strong medium angular blocky; extremely hard, very firm, very sticky and plastic; common thin clay films on peds; moderately alkaline; gradual wavy boundary.

B22t—13 to 18 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to strong coarse angular blocky; extremely hard, very firm, very sticky and plastic; few thin clay films on face of peds; few gypsum crystals; bleached sand grains on faces of peds; very slight effervescence; strongly alkaline; gradual wavy boundary.

B3acs—18 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate coarse and medium angular blocky; hard, firm, very sticky and plastic; rounded medium sized soft masses of segregated lime; many small nests of gypsum; strong effervescence; strongly alkaline; gradual wavy boundary.

C1cacs—30 to 42 inches; light olive gray (5Y 6/2) silty clay loam, olive gray and olive (5Y 5/2 and 4/3) moist; moderate coarse and medium angular blocky structure; very hard, very firm, very sticky and very plastic; many large nests of gypsum; violent effervescence; strongly alkaline; clear wavy boundary.

C2cs—42 to 53 inches; light gray and pale yellow (2.5Y 7/2 and 7/3) silty clay, light brownish gray and grayish brown (2.5Y 6/2 and 5/2) moist; massive; extremely hard, very firm, very sticky and plastic; many large nests of gypsum; many shale fragments; strongly alkaline; clear wavy boundary.

C3—53 to 60 inches; pale yellow (2.5Y 8/4) soft shale crushing to silty clay loam, light olive brown (2.5Y 5/4) moist; slightly acid.

In some places there is a thin A1 horizon. The combined thickness of the A1 horizon, where present, and the A2 horizon is 1 to 5 inches. The A2 horizon is grayish brown or dark grayish brown. It is loam, silt loam, fine sandy loam, or clay loam. In some places the A2 horizon consists only of uncoated sand grain coatings on the columns of the B2t horizon. The B2t horizon is clay loam, silty clay loam, silty clay, or clay.

Rhoades soils are near Belfield, Daglum, Savage, Morton, and Lawther soils. Unlike Belfield, Lawther, Morton, and Savage soils, Rhoades soils have columnar structure. They have columnar structure at a shallower depth than Daglum soils.

RsA—Rhoades-Belfield complex, 1 to 3 percent slopes. This complex is on uplands, terraces, and fans. The Belfield soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. Scab spots and a pitted microrelief are in areas of these soils. This complex consists of about 50 percent Rhoades soil and 40 percent Belfield soil.

Included with these soils in mapping are small areas of Daglum, Harriet, and Moreau soils.

Runoff is slow. Salinity and alkalinity and a shallow root zone are the main limitations to the use of these soils. Proper range use is the main concern of management.

Most areas of these soils are in native range. Capability unit VIs (Thin Claypan); Rhoades part in Thin Claypan range site, Belfield part in Clayey range site.

RsC—Rhoades-Belfield complex, 3 to 9 percent slopes. This complex is on uplands, terraces, and fans. The Belfield soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The surface in areas of these soils has a pitted microrelief. This complex consists of about 50 percent Rhoades soil and 35 percent Belfield soil.

Runoff is medium. Salinity and alkalinity and a shallow root zone are the main limitations. Proper range use is the main concern of management.

Almost all areas of these soils are in native range. Capability unit VIs (Thin Claypan); Rhoades part in Thin Claypan range site, Belfield part in Clayey range site.

RxB—Rhoades complex, 1 to 6 percent slopes. This complex is on uplands, terraces, and fans. The Rhoades soil in this complex has the profile described as representative of the series. The surface has a pitted microrelief and has a scabby appearance. The complex is about 70 percent Rhoades soil and 20 percent Daglum and Belfield soils.

Runoff is slow to medium. Salinity and alkalinity and low available water capacity are the main limitations. Proper range use is the main concern of management.

Almost all areas of this mapping unit are in native range. Capability unit VIs (Thin Claypan); Thin Claypan range site.

Ringling Series

The Ringling series consists of shallow, well drained, gently sloping, medium textured soils on uplands. These

soils formed in material weathered from hard baked shale or from porcellanite rocks.

In a representative profile the surface layer is brown channery loam about 4 inches thick. The underlying material is reddish gray very channery loam about 6 inches thick and, below that, pink hard porcellanite beds.

Permeability is rapid, and the available water capacity is very low. Organic-matter content and fertility are low.

These soils are used mostly for native range. They are not suited to cultivated crops.

Representative profile of Ringling channery loam, in an area of Searing-Ringling stony loams, 3 to 6 percent slopes, in native range 800 feet west and 700 feet south of the northeastern corner of the northwest quarter of sec. 9, T. 135 N., R. 102 W.

A1—0 to 4 inches; brown (7.5Y 4/2) channery loam, dark brown (7.5Y 3/2) moist; moderate fine granular structure; soft, friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

C1—4 to 10 inches; reddish gray (5YR 5/2) very channery loam, dark brown (7.5Y 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; neutral; clear irregular boundary.

C2—10 to 40 inches; pink (5YR 7/4) porcellanite, reddish brown (5YR 4/4) moist; platy hard beds with loamy material partially filling the voids in the upper part.

The A horizon is dark brown, brown, or reddish gray. The depth to porcellanite is 10 to 20 inches.

Ringling soils are near Cabba, Brandenburg, and Searing soils. Unlike Cabba soils, they are underlain by porcellanite. Ringling soils have a thicker A horizon than Brandenburg soils, and they are not so deep as Searing soils.

Ringling soils in Slope County are mapped only in complex with Searing soils.

Savage Series

The Savage series consists of deep, well drained, nearly level to gently sloping, moderately fine textured soils on terraces, fans, and slopes below higher uplands. These soils formed in alluvium.

In a representative profile the surface layer is dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part is grayish brown silty clay about 10 inches thick, and the lower part is light yellowish brown calcareous silty clay about 10 inches thick. The underlying material is light brownish gray calcareous silty clay.

Permeability is moderately slow, and the available water capacity is high. Organic-matter content is moderate, and fertility is high.

These soils are well suited to small grain and grass. They are used mostly for crops.

Representative profile of Savage silty clay loam, 1 to 3 percent slopes, 720 feet west and 400 feet north of the southeastern corner of sec. 19, T. 133 N., R. 101 W.

Ap—0 to 6 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure parting to moderate medium and fine granular; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

B21t—6 to 16 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse prismatic structure parting to moderate coarse and medium angular blocky; very hard, very firm, very sticky and very plastic; common thin clay films on peds; few fine pebbles and scoria fragments; mildly alkaline; clear smooth boundary.

B3ca—16 to 26 inches; light yellowish brown (2.5Y 6/3) silty clay, light olive brown (2.5Y 5/3) moist; weak coarse prismatic structure parting to moderate coarse angular blocky; very hard, very firm, very sticky and very plastic; strong effervescence; mildly alkaline; gradual smooth boundary.

C1ca—26 to 40 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium angular blocky structure; hard, firm, very sticky and plastic; few masses of lime; strong effervescence; moderately alkaline; gradual, wavy boundary.

C2ca—40 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; many large nests of gypsum: strong effervescence; moderately alkaline.

The A horizon is very dark grayish brown or dark grayish brown. The B2 horizon is brown, grayish brown, or light olive brown.

Savage soils are near Lawther, Grail, Regent, and Farland soils. They are deeper than Regent soils, and they contain more clay than Farland soils. Unlike Lawther soils, Savage soils have a Bt horizon. They have a thinner A horizon than Grail soils.

SgA—Savage silty clay loam, 1 to 3 percent slopes. This soil is on terraces, fans, and foot slopes. It has the profile described as representative of the series.

Included with this soil in mapping are Grail, Farland, and Lawther soils in similar positions on the landscape.

Runoff is slow. Maintaining fertility and conserving moisture are the main concerns of management.

Almost all areas of this soil are cultivated. Capability unit IIc–7; Clayey range site.

SgB—Savage silty clay loam, 3 to 6 percent slopes. This soil is on fans, terraces, and foot slopes. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Runoff is medium. Soil blowing and water erosion are slight hazards. Maintaining fertility and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIe–7; Clayey range site.

ShA—Savage-Rhoades silty clay loams, 1 to 3 percent slopes. This complex is on terraces. The Rhoades soil has a profile similar to the one described as representa-

tive of the series, but the surface layer is silty clay loam. Scab spots and a pitted microrelief are in areas of the Rhoades soil. This complex consists of about 70 percent Savage soil and 25 percent Rhoades soil.

Runoff is slow. Salinity and alkalinity and the shallow root zone in the Rhoades soil are the main limitations. Improving tilth, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIIs–7P; Savage part in Clayey range site, Rhoades part in Thin Claypan range site.

Searing Series

The Searing series consists of moderately deep, well drained, gently sloping, medium textured soils on uplands. These soils formed in material that weathered from shale and porcellanite or in clinkers from burned-out coal veins.

In a representative profile the surface layer is brown loam about 6 inches thick. The subsoil is brown loam about 11 inches thick. The underlying material is light brown calcareous loam about 6 inches thick. Red porcellanite bedrock is below that.

Permeability is moderate or moderately rapid, and the available water capacity is low to moderate. Organic-matter content is moderate, and fertility is medium.

These soils are suited to small grain and grass. Most areas are cultivated.

Representative profile of Searing loam, in an area of Searing-Ringling stony loams, 3 to 6 percent slopes, in native range, 530 feet south and 60 feet east of the northwestern corner of sec. 9, T. 135 N., R. 102 W.

A1—0 to 6 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak medium and fine subangular blocky structure; soft, friable, slightly sticky and nonplastic; about 5 percent coarse fragments; neutral; clear smooth boundary.

B2—6 to 17 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 3/4) moist; weak coarse prismatic structure parting to moderate coarse subangular blocky; soft, friable, slightly sticky and nonplastic; about 5 percent coarse fragments; strong effervescence; mildly alkaline; clear smooth boundary.

C1ca—17 to 23 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 4/4) moist; weak coarse and medium subangular blocky structure; soft, friable, slightly sticky and nonplastic; about 15 percent coarse fragments; about 5 percent porcellanite pebbles ½ inch to 6 inches long; strong effervescence; mildly alkaline; clear wavy boundary.

R—23 to 40 inches; red (2.5YR 5/6) porcellanite; fractured plates; some loamy material in the cracks; strong effervescence.

The depth to fractured porcellanite beds is 20 to 40 inches. The A horizon is brown, dark brown, or reddish brown. It is dominantly loam but is silt loam and clay loam in places. The B2 horizon is brown, dark reddish gray, or reddish brown loam or clay loam.

Searing soils are near Ringling, Brandenburg, and Sen soils. They are deeper than Ringling and Brandenburg soils, and they contain more sand and less silt than Sen soils.

SlB–Searing loam, 3 to 6 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is about 3 inches thicker.

Included with this soil in mapping are Searing soils that have slopes of 1 to 3 percent and 6 to 9 percent, Belfield and Absher soils on terraces and fans, and Ringling soils on uplands.

Runoff is medium. Soil blowing and water erosion are moderate hazards. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6G; Silty range site.

SmB—Searing-Ringling stony loams, 3 to 6 percent slopes. This complex is on uplands. These soils have the profile described as representative of their series. About 20 percent of the surface is covered by stones and clinkers that range from 10 to 40 inches in diameter. This complex consists of about 60 percent Searing soil and 35 percent Ringling soil.

Included with these soils in mapping are small areas of Chama, Cabbart, Brandenburg, Absher, and Rhoades soils.

Runoff is medium. Stoniness is the main limitation to the use of these soils. Proper range use is the main concern of management.

All areas of this soil are in native range. Capability unit VIIs (Silty); Searing part in Silty range site, Ringling part in Very Shallow range site.

Sen Series

The Sen series consists of moderately deep, well drained, nearly level to strongly sloping, medium textured soils on uplands. These soils formed in calcareous siltstone.

In a representative profile the surface layer is grayish brown silt loam about 6 inches thick. The subsoil is silt loam about 11 inches thick. It is grayish brown in the upper part and light yellowish brown in the lower part. The underlying material is pale yellow calcareous silt loam about 6 inches thick, white calcareous silt loam about 11 inches, and below that, pale yellow and pale olive soft sedimentary beds.

Permeability is moderate, and the available water capacity is high. Organic-matter content is moderate, and fertility is medium.

These soils are well suited to small grain and grass. They are mostly cultivated. In a few small areas they are in native grass.

Representative profile of Sen silt loam, 3 to 6 percent slopes, in a cultivated field 650 feet south and 180 feet west of the northeastern corner of the southeast quarter of sec. 36, T. 136 N., R. 99 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, slightly

sticky and nonplastic; neutral; abrupt smooth boundary.

B21—6 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

B22—10 to 17 inches; light yellowish brown (2.5Y 6/3) silt loam, olive brown (2.5Y 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and slightly plastic; mildly alkaline; clear wavy boundary.

C1ca—17 to 23 inches; pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and slightly plastic; rounded medium sized soft masses of segregated lime; violent effervescence; mildly alkaline; clear wavy boundary.

C2—23 to 34 inches; white (2.5YR 8/2) silt loam, light yellowish brown (2.5Y 6/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many small concretions of iron; strong effervescence; moderately alkaline; clear wavy boundary.

C3—34 to 39 inches; pale yellow (5Y 7/3) soft beds crushing to loam, pale olive (5Y 7/3) moist; weak coarse platy structure; soft, friable, slightly sticky and nonplastic; slight effervescence; moderately alkaline; abrupt smooth boundary.

C4—39 to 60 inches; pale olive (5Y 6/3) stratified soft beds crushing to loam and fine sandy loam, pale yellow (5Y 7/3) and light yellowish brown (2.5Y 6/4) moist; massive; soft, very friable, nonsticky and nonplastic; very slight effervescence; moderately alkaline.

The A horizon is dark grayish brown or grayish brown. The B2 horizon is grayish brown, light brownish gray, light yellowish brown, or brown. It is silt loam or loam.

Sen soils are near Cabba, Chama, Golva, and Morton soils. They are deeper than Cabba soils, and they are not so deep as Golva soils. Sen soils lack the Bt horizon which Morton soils have, and they have horizons in which calcium has accumulated at a greater depth than Chama soils.

SnA—Sen silt loam, 1 to 3 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thicker.

Included with this soil in mapping are Sen soils that have a lighter colored surface layer.

Runoff is slow. Conserving moisture and maintaining fertility are the main concerns of management.

Almost all areas of this soil are cultivated. Capability unit IIc–6; Silty range site.

SnB—Sen silt loam, 3 to 6 percent slopes. This soil is on uplands. It has the profile described as representative of the series.

Included with this soil in mapping are Sen soils that have a lighter colored surface layer than this Sen soil.

Runoff is medium. Soil blowing is a slight hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Almost all areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

SnC—Sen silt loam, 6 to 9 percent slopes. This soil is on uplands. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Sen soils that have a lighter colored surface layer than this Sen soil.

Runoff is medium to rapid. Soil blowing and water erosion are moderate hazards. Controlling erosion, maintaining fertility, and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6; Silty range site.

SoB—Sen-Golva silt loams, 3 to 6 percent slopes. This complex is on uplands and fans and in swales. The Sen soil has a profile similar to the one described as representative of the series, but the surface layer and subsoil are lighter colored. This complex consists of about 55 percent Sen soil and 40 percent Golva soil.

Included with these soils in mapping are small areas of Chama and Grassna soils.

Runoff is medium. Soil blowing is a slight hazard. Conserving moisture and maintaining fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIe–6; Silty range site.

SoC—Sen-Golva silt loams, 6 to 9 percent slopes. This complex is on uplands and fans and in swales. The Sen soil has a profile similar to the one described as representative of the series, but the surface layer and subsoil are lighter colored. The Golva soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. This complex consists of about 50 percent Sen soil and 35 percent Golva soil.

Included with these soils in mapping are small areas of Chama and Grassna soils.

Runoff is medium. Soil blowing and water erosion are moderate hazards. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIIe–6; Silty range site.

SrD—Sen and Amor soils, 9 to 15 percent slopes. This mapping unit is an undifferentiated group of soils on uplands. Some areas consists of nearly all Sen soils, and some consist of nearly all Amor soils. The surface layer ranges from loam to silt loam. These soils have a profile similar to the one described as representative of their series, but the surface layer is thinner.

Included in mapping are Sen and Amor soils that have a lighter colored surface layer and subsoil.

Runoff is rapid. Water erosion and soil blowing are

moderate hazards. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are in native range. Capability unit IVe–6; Silty range site.

Sham Series

The Sham series consists of deep, well drained, nearly level to strongly sloping, medium textured soils on fans and terraces. These soils formed in stratified local alluvium.

In a representative profile the surface layer is grayish brown loam about 3 inches thick. The underlying material is grayish brown loam about 3 inches thick and, below that, light brownish gray stratified fine sandy loam, loam, silt loam, and silty clay loam.

Permeability is slow, and the available water capacity is moderate. Organic-matter content is low, and fertility is medium.

These soils are used mainly for native range. They are not suited to cultivated crops.

Representative profile of Sham loam, in an area of Sham complex, 1 to 9 percent slopes, in native range 350 feet west and 570 feet north of the southeastern corner of the northeast quarter of sec. 32, T. 133 N., R. 105 W.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure parting to weak medium and fine granular; slightly hard, friable, slightly sticky and nonplastic; mildly alkaline; clear smooth boundary.

C1—3 to 6 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, friable, slightly sticky and nonplastic; strongly alkaline; clear wavy boundary.

C2—6 to 17 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; weak coarse and medium platy structure; hard, very friable, nonsticky and nonplastic; strong effervescence; strongly alkaline; abrupt smooth boundary.

C3—17 to 24 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; extremely hard, firm, slightly sticky and slightly plastic; small masses of segregated lime; strong effervescence; strongly alkaline; gradual wavy boundary.

C4—24 to 60 inches; light brownish gray (2.5Y 6/2) stratified silt loam, silty clay loam, and fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; very hard, friable, slightly sticky and slightly plastic; small masses of segregated lime; strong effervescence; strongly alkaline.

The A horizon is brown, grayish brown, or light brownish gray. The C horizon is stratified loam, silt loam, or fine sandy loam. Stratified layers are 1 inch to 4 inches thick, and they are finer textured or coarser textured in some places.

Sham soils are near Patent and Absher soils. Sham soils contain less clay than these soils, and they lack the columnar structure which Absher soils have.

SsC—Sham complex, 1 to 9 percent slopes. This complex is on fans and terraces. The Sham soil in this complex has the profile described as representative of the series.

This complex is about 70 percent Sham soil. The rest is Glendive, Patent, Absher, Benz, and Ekalaka soils on fans and terraces.

Runoff is medium to rapid. Water erosion is a serious hazard. Maintaining a good grass cover is the main concern of management.

Almost all areas of this complex are in grass. Capability unit VIe (Claypan) ; Claypan range site.

Shambo Series

The Shambo series consists of deep, well drained, nearly level to gently sloping, medium textured soils on terraces and fans in stream valleys. These soils formed in alluvium.

In a representative profile the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is about 17 inches thick. The upper part is brown loam about 13 inches thick, and the lower part is grayish brown loam about 4 inches thick. The underlying material is light gray calcareous loam about 15 inches thick, light brownish gray gravelly sandy loam about 6 inches thick, and below that, light olive gray loamy fine sand.

Permeability is moderate over moderately rapid, and the available water capacity is high. Organic-matter content is moderate, and fertility is high.

These soils are used for crops, hay, pasture, and native range. They are suited to cultivated crops commonly grown in the county. In some areas they are suited to irrigation.

Representative profile of Shambo loam, 1 to 3 percent slopes, in cropland 910 feet west and 60 feet north of the southeastern corner of sec. 20, T. 133 N., R. 102 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and nonplastic; neutral; abrupt smooth boundary.

A12—6 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; neutral; clear wavy boundary.

B2—9 to 22 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; moderate coarse and medium subangular blocky structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and nonplastic; mildly alkaline; gradual wavy boundary.

B3—22 to 26 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure parting to weak thick platy; slightly hard, friable, slightly sticky and nonplastic; about 5 percent coarse fragments; rounded small soft masses of segregated lime; moderately alkaline; clear wavy boundary.

C1ca—26 to 41 inches; light gray (2.5Y 72) loam, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure parting to moderate thick platy; slightly hard, friable, slightly sticky and nonplastic; about 10 percent coarse fragments; rounded medium sized soft masses of segregated lime; violent effervescence; moderately alkaline; clear wavy boundary.

IIC2—41 to 47 inches; light brownish gray (2.5Y 6/2) gravelly sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; strong effervescence; moderately alkaline; clear wavy boundary.

IIC3—47 to 60 inches; light olive gray (5Y 6/2) loamy fine sand, olive (5Y 5/3) moist; single grained; loose, very friable, nonsticky and nonplastic; few small pebbles; strong effervescence; moderately alkaline.

The A horizon is dark grayish brown or grayish brown. The B2 horizon is loam, silt loam, or clay loam. The depth to gravel and sand is 40 to 60 inches.

Shambo soils are near Arnegard, Amor, Belfield, Reeder, and Stady soils. They are deeper than Amor and Reeder soils, and they lack the Bt horizon which Belfield soils have. Shambo soils have a thinner A horizon than Arnegard soils, and they contain less sand and gravel in the IIC horizon than Stady soils.

StA—Shambo loam, 1 to 3 percent slopes. This soil is on terraces and fans. It has the profile described as representative of the series.

Included with this soil in mapping are Amor, Golva, and Stady soils on terraces and fans.

Runoff is slow. Conserving moisture and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Some areas are suited to irrigation. Capability unit IIc–6; Silty range site.

StB—Shambo loam, 3 to 6 percent slopes. This soil is on terraces and fans. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Amor, Golva, and Stady soils on terraces and fans.

Runoff is slow to medium. Soil blowing and water erosion are slight hazards. Conserving moisture and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIe–6; Silty range site.

Stady Series

The Stady series consists of deep, well drained, nearly level to moderately sloping, medium textured soils on terraces. These soils formed in alluvium.

In a representative profile the surface layer is dark grayish brown loam about 6 inches thick. The subsoil is about 12 inches thick. The upper part is brown loam about 6 inches thick, the middle part is grayish brown loam about 3 inches thick, and the lower part is light brownish gray calcareous loam about 3 inches thick. The underlying material is light brownish gray calcareous loam about 11 inches thick, light brownish gray sand and gravel about 13 inches thick, and below that, light yellowish brown sand and gravel.

Permeability is moderate in the upper layers and very rapid in the sand and gravel layers. The available water capacity is low. Organic-matter content is moderate, and fertility is medium.

These soils are used for crops, pasture, range, and hay. They are suited to crops commonly grown in the county. In some areas they are suited to irrigation.

Representative profile of Stady loam, 1 to 3 percent slopes, in a cultivated field 115 feet east and 220 feet north of the southwestern corner of sec. 35, T. 133 N., R. 100 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

B21—6 to 12 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; strong coarse prismatic structure parting to moderate medium subangular blocky; soft, friable, slightly sticky and slightly plastic; thin clay films on faces of peds; neutral; gradual smooth boundary.

B22—12 to 15 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure; soft, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

B3ca—15 to 18 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; soft, friable, slightly sticky and slightly plastic; strong effervescence; mildly alkaline; clear wavy boundary.

C1ca—18 to 29 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, friable, slightly sticky and nonplastic; common soft masses of lime; violent effervescence; moderately alkaline; clear wavy boundary.

IIC2ca—29 to 42 inches; light brownish gray (2.5Y 6/2) sand and gravel, grayish

brown (2.5Y 5/2) moist; single grained; loose, nonsticky and nonplastic; crust of lime on bottom of pebbles; violent effervescence; moderately alkaline; gradual wavy boundary.

IIC3—42 to 60 inches; light yellowish brown (10YR 6/4) sand and gravel, dark yellowish brown (10YR 4/4) moist; single grained; loose, nonsticky and nonplastic; strong effervescence; moderately alkaline.

The A horizon is dark grayish brown or grayish brown. The B2 horizon is grayish brown, dark grayish brown, light brownish gray, or brown. It is loam or silt loam. The depth to gravel and sand is 20 to 40 inches.

Stady soils are on a landscape similar to that of Manning, Shambo, and Wabek soils. They are deeper to sand and gravel than Wabek soils, and they contain more sand and gravel in the IIC horizon than Shambo soils. Stady soils contain more clay above the IIC horizon than Manning soils.

SyA—Stady loam, 1 to 3 percent slopes. This soil is on terraces. It has the profile described as representative of the series.

Included with this soil in mapping are Manning, Shambo, and Parshall soils on terraces.

Runoff is slow. Soil blowing is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIs–6G; Silty range site.

SyB—Stady loam, 3 to 6 percent slopes. This soil is on terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Shambo, Parshall, and Reeder soils on terraces.

Runoff is slow to medium. Soil blowing is a moderate hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–6G; Silty range site.

SzC—Stady and Manning soils, 6 to 9 percent slopes. This mapping unit is an undifferentiated group of soils on terraces. These soils have a profile similar to the one described as representative of their series, but the surface layer is thinner. The surface layer ranges from fine sandy loam to loam.

Some areas consist of nearly all Stady soils, and some areas consist of only Manning soils. Included in mapping with these soils are Wabek soils.

Runoff is medium. Soil blowing and erosion are serious hazards. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IVe–6G; Stady part in Silty range site, Manning part in Sandy range site.

Tally Series

The Tally series consists of deep, well drained, nearly level to moderately sloping, moderately coarse textured soils on fans, terraces, and uplands. These soils formed in alluvium or windblown sediment.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 10 inches thick. The subsoil is grayish brown fine sandy loam about 8 inches thick. The underlying material is light brownish gray calcareous fine sandy loam about 24 inches thick and, below that, light gray loamy fine sand.

Permeability is moderately rapid or rapid, and the available water capacity is moderate. Organic-matter content is moderate, and fertility is medium.

These soils are used mainly for crops, hay, and pasture. They are suited to cultivated crops, trees, and grasses commonly grown in the county. In some areas they are suited to irrigation.

Representative profile of Tally fine sandy loam, 1 to 3 percent slopes, in cropland, 135 feet south and 200 feet east of the northwest corner of the northeast quarter of sec. 29, T. 133 N., R. 100 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

A12—7 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; neutral; clear wavy boundary.

B2—10 to 18 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable, nonsticky and nonplastic; neutral; gradual wavy boundary.

C1ca—18 to 29 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure; soft, very friable, nonsticky and nonplastic; strong effervescence; neutral; gradual wavy boundary.

C2ca—29 to 42 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; soft, very friable, nonsticky and nonplastic; few small masses of lime; strong effervescence; neutral; clear wavy boundary.

C2—42 to 60 inches; light gray (5Y 7/2) loamy fine sand, olive (5Y 5/3) moist; single grained; soft, loose, nonsticky and nonplastic; strong effervescence; mildly alkaline.

The A horizon is dark grayish brown or grayish brown. The B2 horizon is grayish brown or brown fine sandy loam or sandy loam.

Tally soils are on a landscape similar to that of Desart, Flasher, Parshall, and Vebar soils. They do not have columnar structure, which Desart soils have, and

they are deeper than Flasher and Vebar soils. Tally soils have a thinner B horizon than Parshall soils.

TaA—Tally fine sandy loam, 1 to 3 percent slopes. This soil is on fans and terraces. It has the profile described as representative of the series.

Included in mapping are Ekalaka, Parshall, Manning, and Vebar soils on fans and terraces.

Runoff is slow. Soil blowing is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–3; Sandy range site.

TaB—Tally fine sandy loam, 3 to 6 percent slopes. This soil is on fans and terraces. It has a profile similar to the one described as representative of the series, but the surface layer is thinner.

Included with this soil in mapping are Ekalaka, Parshall, Vebar, and Manning soils on fans and terraces.

Runoff is slow. Soil blowing is a moderate hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of this soil are cultivated. Capability unit IIIe–3; Sandy range site.

Telfer Series

The Telfer series consists of deep, excessively drained, nearly level to moderately sloping, coarse textured soils on terraces and uplands. These soils formed in wind- and water-deposited materials.

In a representative profile the surface layer is brown loamy fine sand about 7 inches thick. Below this is a transitional layer of brown loamy fine sand about 6 inches thick. The underlying material is light yellowish brown fine sand.

Permeability is rapid, and the available water capacity is low. Organic-matter content is moderate, and fertility is low.

These soils are used for crops, hay, and pasture. They are best suited to grasses.

Representative profile of Telfer loamy fine sand, in an area of Telfer-Lihen loamy fine sands, 6 to 9 percent slopes, in grassland 60 feet west and 290 feet north of the southeastern corner of the northeast quarter of sec. 32, T. 135 N., R. 100 W.

A1—0 to 7 inches; brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

AC—7 to 13 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; neutral; gradual smooth boundary.

C—13 to 60 inches; light yellowish brown (2.5Y 6/4) fine sand, light olive brown (2.5Y 5/4) moist; single grained; loose, very friable; nonsticky and nonplastic; neutral.

The A horizon ranges from loamy sand to sandy loam but is dominantly loamy fine sand. In some places soft sandstone is at a depth of more than 40 inches.

Telfer soils are near Lihen, Vebar, and Tally soils. Telfer soils have a thinner A horizon than Lihen soil, they are deeper than Vebar soils, and they contain more sand than Tally soils.

TeB—Telfer-Lihen loamy fine sands, 1 to 6 percent slopes. This complex is on terraces and uplands. The soils have a profile similar to one described as representative of their series, but the surface layer is thicker. This complex consists of about 55 percent Telfer soil and 40 percent Lihen soil.

Included with these soils in mapping are small areas or Vebar and Flasher soils.

Runoff is slow. Soil blowing is a severe hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are in pasture. Capability unit IVe–2; Sands range site.

TeC–Telfer-Lihen loamy fine sands, 6 to 9 percent slopes. This complex is on terraces and uplands. The soils have the profile described as representative of their series. The complex consists of about 60 percent Telfer soil and 35 percent Lihen soil.

Included with these soils in mapping are small areas of Flasher and Vebar soils.

Runoff is slow. Soil blowing is a very severe hazard. Maintaining a good grass cover is the main concern of management.

Almost all areas of these soils are in native range and grass. Capability unit VIe (Sands); Sands range site.

Vebar Series

The Vebar series consists of moderately deep, well drained, gently sloping to strongly sloping, moderately coarse textured soils on uplands. These soils formed in material weathered from soft sandstone.

In a representative profile the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsoil is fine sandy loam about 20 inches thick. It is light olive brown in the upper 8 inches and grayish brown in the lower 12 inches. The underlying material is light brownish gray calcareous fine sandy loam about 11 inches thick and, below that, light brownish gray and pale olive soft sandstone.

Permeability is moderately rapid, and the available water capacity is low to moderate. Organic-matter content is moderate, and fertility is medium.

Vebar soils are used for crops, hay, and pasture. They are suited to cultivated crops commonly grown in the county.

Representative profile of Vebar fine sandy loam, in an area of Vebar-Tally fine sandy loams, 3 to 6 percent slopes, in cropland 50 feet east and 570 feet south of the northwestern corner of the southwest quarter of sec. 25, T. 134 N., R. 98 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; soft, friable, nonsticky and nonplastic; mildly alkaline; abrupt smooth boundary.

B2—7 to 15 inches; light olive brown (2.5Y 5/4) fine sandy loam, dark brown (10YR 3/3) moist; moderate coarse and medium pris-

matic structure parting to moderate medium subangular blocky; soft, friable, nonsticky and nonplastic; neutral; gradual wavy boundary.

B3—15 to 27 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; neutral; gradual wavy boundary.

C1ca—27 to 36 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; small masses of lime; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—36 to 50 inches; light brownish gray (2.5Y 6/2) soft sandstone crushing to fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; soft, friable, nonsticky and nonplastic; small masses of lime; strong effervescence; mildly alkaline; diffuse wavy boundary.

C3—50 to 60 inches; pale olive (5Y 6/3) soft sandstone crushing to fine sandy loam, olive (5Y 5/3) moist; massive; soft, friable, nonsticky and nonplastic; slight effervescence; mildly alkaline.

The A horizon is very dark grayish brown or dark grayish brown. The B2 horizon is light olive brown, grayish brown, light brownish gray, or brown. The depth to soft sedimentary sandstone is 20 to 40 inches.

Vebar soils are on a landscape similar to that of Flasher, Parshall, Tally, Lihen, and Telfer soils. Vebar soils are deeper than Flasher soils, but they are not so deep as Parshall, Tally, Lihen, and Telfer soils.

VfC—Vebar-Flasher fine sandy loams, 3 to 9 percent slopes. This complex is on uplands. The Flasher soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam.

This complex consists of about 65 percent Vebar soil and 25 percent Flasher soil. The rest is Telfer, Ekalaka, and Amor soils on uplands.

Runoff is slow to medium. Soil blowing is a serious hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IVe–3; Vebar part in Sandy range site, Flasher part in Shallow range site.

VfD—Vebar-Flasher fine sandy loams, 9 to 15 percent slopes. This complex is on uplands. The Vebar soil has a profile similar to the one described as representative of the series, but the surface layer is thinner. The Flasher soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam.

This complex consists of about 55 percent Vebar soil and 30 percent Flasher soil. The rest is Lihen, Lefor, and Parshall soils on uplands.

Runoff is medium. Water erosion and soil blowing are severe hazards. Controlling erosion and proper range use are the main concerns of management.

Most areas of these soils are in native range. Capability unit VIe (Sandy); Vebar part in Sandy range site, Flasher part in Shallow range site.

VrB—Vebar-Tally fine sandy loams, 3 to 6 percent slopes. This complex is on uplands. The Vebar soil has the profile described as representative of the series.

This complex consists of about 60 percent Vebar soil and 25 percent Tally soil. The rest is Sen, Amor, Flasher, and Arnegard soils on uplands.

Runoff is medium. Soil blowing is a moderate hazard. Controlling erosion, conserving moisture, and maintaining fertility are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IIIe–3; Sandy range site.

VrC—Vebar-Tally fine sandy loams, 6 to 9 percent slopes. This complex is on uplands, fans, and terraces. These soils have a profile similar to the one described as representative of their series, but the surface layer is thinner. This complex consists of about 70 percent Vebar soil and 20 percent Tally soil.

Runoff is medium. Soil blowing is a severe hazard. Controlling erosion and conserving moisture are the main concerns of management.

Most areas of these soils are cultivated. Capability unit IVe–3; Sandy range site.

Wabek Series

The Wabek series consists of shallow over sand and gravel, excessively drained, gently sloping to moderately steep, medium textured soils on outwash plains and terraces. These soils formed in gravelly alluvium.

In a representative profile the surface layer is brown loam about 4 inches thick. The underlying material is brown gravelly loam about 4 inches thick, pale brown gravelly coarse sandy loam about 10 inches thick, light brownish gray and light yellowish brown sand and gravel about 26 inches thick, and below that, pale yellow sand.

Permeability is very rapid, and the available water capacity is very low. Organic-matter content is moderate, and fertility is low.

These soils are not suited to cultivated crops. They are mostly in native grass.

Representative profile of Wabek loam, 3 to 25 percent slopes, in native range 240 feet east and 45 feet south of the northwestern corner of the northeast quarter of sec. 34, T. 134 N., R. 100 W.

A1—0 to 4 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; soft, friable, slightly sticky and nonplastic; about 5 percent gravel; slightly acid; clear smooth boundary.

C1—4 to 8 inches; brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, friable, slightly sticky and nonplastic; about 25 percent gravel; neutral; clear smooth boundary.

IIC1—8 to 18 inches; pale brown (10YR 6/3) gravelly coarse sandy loam, dark brown (10YR 4/3) moist; single grained; very soft, very friable, nonsticky and non-

plastic; about 45 percent gravel; neutral; clear wavy boundary.

IIC2—18 to 44 inches; light brownish gray and light yellowish brown (2.5Y 6/2 and 6/4) sand and gravel, dark grayish brown and olive brown (2.5Y 4/2 and 4/4) moist; single grained; loose, very friable, nonsticky and nonplastic; neutral; gradual wavy boundary.

IIIC3—44 to 60 inches; pale yellow (5Y 7/3) sand, olive (5Y 4/3) moist; single grained; loose, very friable, nonsticky and nonplastic; mildly alkaline.

The A horizon is dark grayish brown or brown. The depth to sand and gravel is 7 to 14 inches.

Wabek soils are near Manning and Stady soils. They are shallower to sand and gravel than these soils.

WaE—Wabek loam, 3 to 25 percent slopes. This soil is on outwash plains and terraces.

Included with this soil in mapping are Wabek soils that have thin gravel layers overlying soft bedded sandstone and shale.

Runoff is slow. Low available water capacity is the main limitation to the use of this soil. Proper range use is the main concern of management.

Nearly all areas of this soil are in native range. Capability unit VIs (Very Shallow); Very Shallow range site.

Wayden Series

The Wayden series consists of shallow, well drained, nearly level to moderately sloping, fine textured soils on uplands. These soils formed in material weathered from shale, soft claystone, and siltstone.

In a representative profile the surface layer is light olive gray silty clay about 6 inches thick. The underlying material is light gray silty clay about 6 inches thick, light gray soft shale about 11 inches thick, and below that, white soft shale.

Permeability is slow, and the available water capacity is low. Organic-matter content and fertility are low.

These soils are mostly in native grass. They are better suited to grass than to other crops.

Representative profile of Wayden silty clay, 1 to 9 percent slopes, in grass 980 feet east and 210 feet south of the northwestern corner of sec. 23, T. 136 N., R. 100 W.

A1—0 to 6 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 4/2) moist; weak medium granular structure; hard, firm, sticky and plastic; mildly alkaline; diffuse irregular boundary.

C1—6 to 12 inches; light gray (5Y 7/2) silty clay, light olive gray (5Y 6/2) moist; moderate coarse angular blocky structure; hard, firm, sticky and plastic; moderately alkaline; clear wavy boundary.

C2—12 to 23 inches; light gray (5Y 7/1 and 7/2) soft platy shale crushing to silty clay, light olive gray and pale olive (5Y 6/2 and 6/3) moist; massive; hard, firm, sticky and plastic; many gypsum crystals; slight effervescence; moderately alkaline; gradual wavy boundary.

C3—23 to 60 inches; white (5Y 8/1 and 8/2) soft platy shale crushing to silty clay, gray and light olive gray (5Y 6/1 and 6/2) moist; massive; hard, firm, sticky and plastic; mildly alkaline.

The A horizon is light olive gray, light brownish gray, or grayish brown. The depth to sedimentary beds is 10 to 20 inches.

Wayden soils are near Cabba and Moreau soils. They contain more clay than Cabba soils, and they are shallower than Moreau soils.

WyC—Wayden silty clay, 1 to 9 percent slopes. This soil is on uplands.

Included with this soil in mapping are Moreau, Rhoades, and Cabba soils on uplands.

Runoff is medium to rapid. Low available water capacity and a shallow root zone are the main limitations to the use of this soil. Water erosion is a severe hazard. Control of erosion and proper range use are the main concerns of management.

Most areas of this soil are in native range. Capability unit VIe (Shallow Clay); Shallow Clay range site.

Yetull Series

The Yetull series consists of deep, well drained, moderately sloping to moderately steep, coarse textured soils on terraces and uplands. These soils formed in alluvium or wind-deposited material.

In a representative profile the surface layer is brown loamy coarse sand about 6 inches thick. The underlying material is yellowish brown loamy coarse sand about 5 inches thick and, below that, pale yellow coarse sand.

Permeability is rapid, and the available water capacity is very low. Organic-matter content and fertility are low.

These soils are mostly in native grass. They are not suited to cultivated crops.

Representative profile of Yetull loamy coarse sand, 6 to 25 percent slopes, in native grass 1,680 feet north and 400 feet west of the southeastern corner of sec. 36, T. 135 N., R. 104 W.

A1—0 to 6 inches; brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; weak moderate subangular blocky structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

C1—6 to 11 inches; yellowish brown (10YR 5/4) loamy coarse sand, dark yellowish brown (10YR 4/4) moist; single grained; soft, very friable, nonsticky and nonplastic; neutral; gradual wavy boundary.

C2—11 to 60 inches; pale yellow (2.5Y 7/4) coarse sand, light olive brown (2.5Y 5/4) moist; single grained; soft, very friable, nonsticky and nonplastic; mildly alkaline.

The A horizon is brown or grayish brown.

Yetull soils are near Chinook soils. They contain more coarse sand and less fine sand than Chinook soils.

YeE—Yetull loamy coarse sand, 6 to 25 percent slopes. This soil is on terraces and uplands. Slopes are short and choppy.

Runoff is very slow to slow. Soil blowing is a very serious hazard. The very low available water capacity is the chief limitation to the use of this soil. Proper range use is the main concern of management.

Nearly all areas of this soil are in native range. Capability unit VIIe (Sands) ; Sands range site.

Zeona Series

The Zeona series consists of deep, excessively drained, nearly level to moderately sloping, coarse textured soils on terraces and uplands. These soils formed in wind-deposited sand.

In a representative profile the surface layer is light brownish gray loamy fine sand about 5 inches thick. The underlying material is light brownish gray fine sand about 20 inches thick, light gray fine sand about 13 inches thick, and, below that, light brownish gray fine sand.

Permeability is rapid, and the available water capacity is low. Organic-matter content is very low, and fertility is low.

These soils are used mainly for grass and as wildlife habitat. They are not suited to cultivated crops.

Representative profile of Zeona loamy fine sand, 1 to 9 percent slopes, in native range 500 feet east and 650 feet north of the southwest corner of the northwest quarter of sec. 33, T. 135 N., R. 105 W.

A1—0 to 5 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; single grained; soft, very friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

C1—5 to 14 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose, nonsticky and nonplastic; neutral; clear wavy boundary.

C2—14 to 25 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, nonsticky and nonplastic; neutral; gradual wavy boundary.

C3—25 to 38 inches; light gray (2.5Y 7/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, nonsticky and nonplastic; moderately alkaline; gradual wavy boundary.

C4—38 to 60 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; single grained; loose, nonsticky and nonplastic; moderately alkaline.

The A horizon is grayish brown or light brownish gray.

Zeona soils are near Fleak, Hanly, and Rhame soils. They are deeper than Fleak and Rhame soils, and they are less alkaline above a depth of 25 inches than Hanly soils.

ZfC—Zeona loamy fine sand, 1 to 9 percent slopes. This soil is on terraces and uplands. It has the profile described as representative of the series. Slopes are nearly level to hummocky.

Runoff is very slow. Soil blowing is a serious hazard. Control of erosion and proper range use are the main concerns of management.

Almost all areas of this soil are in native range. Capability unit VIe (Sands) ; Sands range site.

Use and Management of the Soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Cropland [2]

About 38 percent of Slope County is cultivated.

[2] By EDWARD R. WEIMER, agronomist, Soil Conservation Service.

Spring wheat is the principal crop. Winter wheat, oats, and barley are other important crops.

The main considerations in managing cultivated soils in this county are conserving moisture, controlling soil blowing and erosion, and maintaining tilth and fertility.

Conserving moisture in dryfarmed areas generally includes measures for reducing evaporation, limiting runoff, increasing infiltration, and controlling weeds. Effective methods include stubble mulching, contour farming, stripcropping, field windbreaks, buffer strips, timely tillage, minimum tillage, use of crop residue, and application of fertilizer. Fallowing helps to control weeds and increase the moisture content of the soils.

Cover crops, stripcropping, buffer strips, windbreaks, contour farming, diversions, grassed waterways, minimum tillage, timely tillage, emergency tillage, and the use of crop residue help to control erosion. Generally, a combination of measures is used.

The application of chemical fertilizer and barnyard manure, use of green manure crops, use of summer fallow, and including cover crops and grasses and legumes in the cropping system help to maintain tilth and fertility. Control of erosion also helps to preserve fertility.

Drainage measures, removal of stones, and reducing salinity and alkalinity of the soils can be used to offset unfavorable soil characteristics.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expansive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*4*). These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use. (No class I soils are in Slope County).

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

An Arabic numeral follows the subclass symbol in classes II, III, and IV. The numeral indicates the susceptibility of the soils to soil blowing. The numbers range from 1, which indicates very high susceptibility, to 7, which indicates slight susceptibility.

In addition, a capital letter follows some subclass symbols in classes II, III, and IV. The letter *P* indicates the presence of a sodic claypan in the soils; *L* indicates that the soils are calcareous; and *G* indicates that gravel is in the substratum.

The name of the range site for the major soils in classes V, VI, and VII is in parentheses following the subclass symbol.

Management by capability units

In the following pages the capability units in Slope County are described, and suggestions for the use and management of the soils are given.

CAPABILITY UNIT IIc–6

This unit consists of moderately deep and deep, nearly level soils. The soils are well drained, medium textured and moderately fine textured. They are in swales and depressions and on uplands, terraces, fans, and bottom lands.

The organic-matter content is moderate or high, and natural fertility is medium or high. The available water capacity is moderate to high, and permeability is moderate to moderately slow. Surface runoff is slow to medium, and areas along streams flood during periods of stream overflow.

These soils are suited to all crops commonly grown in the county, and most areas are tilled. Wheat is the

main crop. These soils are easy to work and have good tilth.

Low rainfall and a short growing season are the main limitations. Susceptibility to soil blowing is slight. Cover crops, conservation of crop residue, stripcropping, field windbreaks, timely tillage, and buffer strips help to reduce erosion and maintain tilth. Summer fallow stores moisture and aids in weed control, but it increases the hazard of soil blowing.

CAPABILITY UNIT IIc–7

This unit consists of moderately deep and deep, nearly level soils. These are well drained, moderately fine textured soils in swales and depressions and on uplands, fans, foot slopes, and terraces. The organic-matter content is moderate to high, and natural fertility is medium to high. The available water capacity is high, and permeability is slow or moderately slow. Surface runoff is slow to medium.

These soils are suited to all crops commonly grown in the county, and most areas are tilled. Wheat is the main crop. These soils are easy to work and have good tilth. If they are worked when wet, however, they become extremely hard when dry.

Low rainfall and a short growing season are the main limitations. Conservation of crop residue, field windbreaks, timely tillage, stripcropping, and buffer strips help to maintain tilth and control erosion. Summer fallow stores moisture and aids in weed control, but it increases the hazard of soil blowing.

CAPABILITY UNIT IIe–6

This unit consists of moderately deep and deep, nearly level and gently sloping soils. These are well drained, medium textured and moderately fine textured soils in swales and on uplands, fans, foot slopes, and terraces. The organic-matter content is low to high, and natural fertility is low to high. The available water capacity is moderate to high, and permeability is moderately slow to moderately rapid. Surface runoff is slow to rapid.

These soils are suited to all crops commonly grown in the county, and most areas are tilled. Wheat is the main crop. These soils are easy to work and have good tilth.

Low rainfall and a short growing season limit the use of these soils for crops. Soil blowing and water erosion are slight hazards. Stripcropping, diversions, sod waterways, contour stripcropping, field windbreaks, conservation of crop residue, and stubble mulching help to maintain tilth and control erosion. Summer fallow stores moisture and aids in weed control, but it increases the hazard of soil blowing.

CAPABILITY UNIT IIe–7

This unit consists of deep and moderately deep, gently sloping soils. These are well drained, moderately fine textured soils in swales and depressions and on uplands, fans, and foot slopes.

The organic-matter content is moderate or high, and natural fertility is high to medium. The available water capacity is high, and permeability is moderately slow to slow. Surface runoff is medium.

These soils are suited to crops commonly grown in the county, and most areas are tilled. Wheat is the main crop. These soils are easy to work and have good tilth.

Susceptibility to water erosion is the main limitation. Grassed waterways, stubble mulching, conservation of crop residue, stripcropping, and diversions help to reduce erosion and maintain tilth.

CAPABILITY UNIT IIs–4

This unit consists of deep, nearly level soils. These are moderately well drained to well drained, fine textured soils in swales and on fans and uplands. The organic-matter content is moderate or moderately low, and natural fertility is low to high. The available water capacity is moderate or high, and permeability is slow. In some of the soils that have a sandy substratum, permeability is rapid in the lower part of the profile. Surface runoff is slow to medium.

These soils are suited to most crops commonly grown in the county, and most areas are tilled. Wheat is the main crop. The soils in this unit are not well suited to row crops. They are very sticky when wet and extremely hard when dry. They must be tilled at the proper moisture content. Because the surface layer tends to slake, the soils are susceptible to soil blowing, particularly if they are summer fallowed or fall plowed.

Susceptibility to soil blowing and poor tilth are the main limitations. Erosion is a concern in some areas. Stripcropping, buffer strips, field windbreaks, conservation of crop residue, and stubble mulching help to reduce erosion and maintain tilth.

CAPABILITY UNIT IIIe–3

This unit consists of moderately deep and deep, nearly level and gently sloping soils. These are moderately well drained to somewhat excessively drained, moderately coarse textured soils in swales, shallow depressions, and intermittent drainageways and on fans, foot slopes, terraces, and uplands.

The organic-matter content is low to high, and natural fertility is low to high. The available water capacity is low to high, and permeability is moderately slow to moderately rapid. In some of the soils that have a finer textured substratum, permeability is moderately slow in the substratum. Surface runoff is slow to medium.

These soils are suited to all crops commonly grown in the county. Most areas are tilled. Wheat is the main crop. These soils are easy to work. They warm up rapidly in spring and are among the first to be cultivated.

Susceptibility to soil blowing and droughtiness caused by the limited available water capacity are the main limitations. Soils in cultivated areas are highly susceptible to soil blowing. Stubble mulching, wind stripcropping, buffer crops, field windbreaks, crop residue management, and cover crops help to reduce erosion. Generally, tillage should be kept to the minimum needed for weed control and seedbed preparation.

CAPABILITY UNIT IIIe–4

This unit consists of deep, gently sloping and moderately sloping soils. These are moderately well drained, fine textured soils on fans and terraces. The organic-matter content is moderate or moderately low, and natural fertility is low to high. The available water

capacity is moderate or high, and permeability is slow. In some soils that have a sandy substratum, permeability is rapid in the lower layers. Surface runoff is medium.

These soils are suited to most crops commonly grown in the county, and most areas are tilled. Wheat is the main crop. These soils are not well suited to row crops. They are very sticky when wet and extremely hard when dry. Tillage must be done at the proper moisture content. Because the surface layer tends to slake, the soils are susceptible to soil blowing, particularly if they are summer fallowed or fall plowed.

Susceptibility to soil blowing and erosion and poor tilth are the main limitations. Stripcropping, diversions, grassed waterways, field windbreaks, conservation of crop residue, and stubble mulching help to reduce erosion.

CAPABILITY UNIT IIIe–6

This unit consists of shallow to deep, nearly level to moderately sloping soils. These are well drained or excessively drained, medium textured and moderately fine textured soils in swales and on uplands, terraces, foot slopes, and fans. The organic-matter content is low to moderate, and natural fertility is low to high. The available water capacity ranges from low to high. Permeability is moderately slow to moderate in most of the soils in this unit. Surface runoff is slow to rapid, and areas along streams flood during periods of stream overflow.

These soils are suited to all crops commonly grown in the county. Wheat is the main crop. These soils are easy to work and have good tilth.

The hazard of water erosion is severe in cultivated areas. Soil material is washed from ridges and upper slopes during periods of intense rainfall or rapid snowmelt. Soil blowing is a slight hazard. Diversions, grassed waterways, conservation of crop residue, stubble mulching, field windbreaks, stripcropping, cover cropping, and contour stripcropping can help to reduce erosion.

CAPABILITY UNIT IIIe–6P

This unit consists of Belfield silt loam, 3 to 6 percent slopes. This is a well drained, medium textured soil in swales and on terraces and uplands. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is moderate, and permeability is moderately slow. Surface runoff is medium.

This soil is suited to most crops grown in the county. Wheat is the main crop. This soil is easy to work and has good tilth.

Moderately slow permeability in the subsoil is the main soil limitation. Wind stripcropping, stubble mulch tillage, including grass and legumes in the cropping system, and using crop residue help to control erosion and maintain tilth.

CAPABILITY UNIT IIIe–6G

This unit consists of deep and moderately deep, gently sloping soils. These are well drained medium textured soils on terraces, fans, and uplands. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is low to moderate, and permeability is moderate in the upper part of the profile and moderately rapid to very rapid in the lower part. Surface runoff is slow to medium.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are easy to work and have good tilth.

Droughtiness, which is caused by the moderately deep root zone and low available water capacity, is the chief limitation. The use of crop residue, stubble mulching, timely and minimum tillage, wind stripcropping, field windbreaks, and buffer strips help to conserve moisture and control erosion.

CAPABILITY UNIT IIIe–6P

This unit consists of moderately deep and deep, nearly level and gently sloping claypan soils. These are moderately well drained and well drained, medium textured soils on uplands, fans, and terraces. The organic-matter content is moderate, and natural fertility is low to high. The available water capacity is moderate to high, and permeability is very slow to moderate. Surface runoff is slow to medium.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are not well suited to row crops. They are easy to work and have good tilth, except where the claypan is mixed with the plow layer.

Slow permeability and a shallow root zone which are caused by the claypan, are the main limitations. Stubble mulch tillage, stripcropping, use of crop residue, and including grass and legumes in the cropping system help to reduce erosion and maintain tilth. Summer fallow and deep tillage are practices beneficial to these soils.

CAPABILITY UNIT IIIe–7P

This unit consists of deep and moderately deep, gently sloping to moderately sloping soils. These are moderately well drained and well drained, moderately fine textured soils on terraces, fans, and uplands. The organic-matter content is moderate, and natural fertility is medium to low. The available water capacity is moderate to high, and permeability is moderately slow to very slow. Surface runoff is medium to rapid.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are not well suited to row crops, and they are poorly suited to trees. Tilth is very poor where the claypan is mixed with the plow layer.

The restricted root zone, which is caused by the claypan subsoil, and a moderate hazard of erosion are the chief limitations. The use of crop residue, stubble mulching, diversions, and grassed waterways and planting alfalfa, sweetclover, and tame grasses in rotation help to maintain tilth and control erosion. Deep tillage helps to increase the intake of water and to leach salts.

CAPABILITY UNIT IIIe–4L

This unit consists of deep and moderately deep, gently sloping soils. These are well drained, medium textured and fine textured soils on uplands, fans, and foot slopes. The organic-matter content is moderately low or moderate, and natural fertility is medium. The available water capacity is moderate, and permeability is slow to moderate. Surface runoff is medium.

These soils are used for crops, hay, and pasture. They

are suited to most crops commonly grown in the county. Wheat is the main crop. The fine textured soils in this unit have poor tilth and are difficult to work.

Soil blowing and water erosion are moderate hazards. Wind stripcropping, the use of diversions and grassed waterways, stubble mulching, and contour stripcropping help to reduce erosion.

CAPABILITY UNIT IIIs-6G

This unit consists of deep, nearly level soils. These are well drained, medium textured soils on fans and terraces. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is low, and permeability is moderate over rapid or very rapid. Surface runoff is slow.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are easy to work and have good tilth.

Low available water capacity is the main limitation to the use of these soils for crops. The hazard of soil blowing is moderate. Wind stripcropping, stubble mulching, use of crop residue, timely tillage, and buffer strips help to reduce erosion and maintain tilth.

CAPABILITY UNIT IIIs-7P

This unit consists of moderately deep and deep, nearly level soils. These are moderately well drained and well drained, moderately fine textured soils on uplands and terraces. Some of the soils in this unit are mapped in complexes with soils that have a claypan subsoil. The organic-matter content is moderate, and natural fertility is low to medium. The available water capacity is moderate to high, and permeability is very slow to moderate. Surface runoff is medium to slow.

The soils in this unit are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are not well suited to row crops, and they are poorly suited to trees. They have good tilth, except where the claypan is mixed with the plow layer.

The shallow root zone of the soils in this unit that have a claypan is the main limitation to the use of these soils for crops. Stubble mulch tillage, crop residue use, and stripcropping help to maintain tilth and control erosion. Deep tillage and summer fallow help to increase the intake of water and to leach salts.

CAPABILITY UNIT IIIs-4L

This unit consists of Moreau silty clay, 1 to 3 percent slopes. This is a well drained, fine textured soil on uplands. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is moderate, and permeability is slow. Surface runoff is medium.

This soil is suited to most crops commonly grown in the county. Wheat is the main crop. This soil is not suited to row crops. It is difficult to till because it is sticky when wet and very hard when dry. Tillage must be done at the proper moisture content. Because the surface layer tends to slake, the hazard of soil blowing is severe. Wind stripcropping, stubble mulch tillage, and use of crop residue help to reduce erosion.

CAPABILITY UNIT IVe-2

This unit consists of Telfer-Lihen loamy fine sands, 1 to 6 percent slopes. The soils are well drained to excessively drained and coarse textured, and they are on uplands and terraces. The organic-matter content is moderate, and natural fertility is medium to low. The available water capacity is moderate to low, and permeability is rapid. Surface runoff is slow.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are easy to work.

Soil blowing is a serious hazard. These soils are droughty because of low available water capacity.

The use of green manure and cover crops, wind stripcropping, stubble mulching, and field windbreaks help to reduce erosion. Fall plowing increases the hazard of erosion. Tillage should be kept to the minimum needed for weed control and seedbed preparation. Summer fallow should be used only for weed control, because it increases the hazard of erosion and limits the amount of moisture that can be stored.

CAPABILITY UNIT IVe-3P

This unit consists of deep, nearly level and gently sloping soils. These are well drained, moderately coarse textured and coarse textured soils on terraces, fans, and uplands. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is low to moderate, and permeability is moderately rapid over slow. Surface runoff is slow to medium.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are not well suited to row crops. They have good tilth and are easy to work.

The severe hazard of soil blowing and droughtiness that is caused by low available water capacity are the chief limitations to the use of these soils for crops. Stubble mulching, wind stripcropping, buffer strips, use of crop residue, and including grass and legumes in the cropping system help to control erosion.

CAPABILITY UNIT IVe-3

This unit consists of shallow to deep, gently sloping and moderately sloping soils. These are well drained to excessively drained, moderately coarse textured soils on uplands, terraces, and fans. The organic-matter content is low to moderate, and natural fertility is low to medium. The available water capacity is very low to high, and permeability is moderately slow to rapid. Surface runoff is slow to medium.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are easy to work.

The hazard of soil blowing is severe. Droughtiness caused by low available water capacity in some of the soils is also a concern. The use of green manure and cover crops, crop residue use, stubble mulch tillage, and field windbreaks help to reduce erosion. Tillage should be kept to the minimum needed for weed control and seedbed preparation. Summer fallow should be used only for weed control, because it increases the hazard of erosion and limits the amount of moisture that can be stored.

CAPABILITY UNIT IVe-6

This unit consists of moderately deep and shallow, moderately sloping to strongly sloping soils. These are well drained to excessively drained, medium textured

soils on uplands. The organic-matter content is low or moderate, and natural fertility is low to medium. The available water capacity is low to high, and permeability is moderately slow to moderate. Surface runoff is medium to rapid.

The soils in this unit suited to most crops commonly grown in the county. Wheat is the main crop. The soils are easy to work and have good tilth.

Water erosion and soil blowing are moderate hazards. Soil material is washed from ridges and upper slopes during periods of heavy rainfall or rapid snowmelt. Stubble mulch tillage, stripcropping, the use of crop residue, grassed waterways, field windbreaks, and contour stripcropping help to reduce erosion. Summer fallow should be used only for weed control.

CAPABILITY UNIT IVe–6G

This unit consists of Stady and Manning soils, 6 to 9 percent slopes. The soils are well drained to somewhat excessively drained, medium textured and moderately coarse textured, and they are on terraces. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is low, and permeability is moderate to very rapid. Surface runoff is medium.

The soils in this unit are suited to most crops commonly grown in the county. They are not suited to row crops. Wheat is the main crop. These soils are easy to work and have good tilth.

Soil blowing and water erosion are severe hazards. Droughtiness caused by the low available water capacity is a serious limitation. The use of crop residue, stubble mulch tillage, stripcropping diversions, grassed waterways, field windbreaks, and cover crops help to reduce erosion and maintain tilth. The amount of moisture that can be stored by summer fallow is limited; therefore, summer fallow should be used only for weed control. Tillage should be kept to the minimum needed for weed control and seedbed preparation.

CAPABILITY UNIT IVe–4L

This unit consists of shallow to moderately deep, gently sloping and moderately sloping soils. These are well drained to excessively drained, fine textured and medium textured soils on uplands. The organic-matter content is low to moderate, and natural fertility is low to medium. The available water capacity is moderate to low, and permeability is moderate to slow. Surface runoff is rapid to medium.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils have poor tilth and are difficult to work.

Water erosion and soil blowing are serious hazards. Grassed waterways, diversions, wind stripcropping, stubble mulch tillage, and field terraces help to maintain tilth and reduce erosion.

CAPABILITY UNIT IVe–3P

This unit consists of Daglum fine sandy loam, 1 to 6 percent slopes. This is a moderately well drained and well drained, moderately coarse textured soil in swales and on uplands, fans, and foot slopes. This soil has a claypan subsoil. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is moderate, and permeability is slow. Surface runoff is slow to medium.

This soil is suited to most crops commonly grown in the county. Wheat is the main crop. This soil has good tilth and is easy to work except where subsoil material is mixed with plow layer.

Soil blowing and slow permeability in the subsoil are the main limitations. Wind stripcropping, stubble mulch tillage, using a rotation of grass and legumes, and use of crop residue help to reduce erosion.

CAPABILITY UNIT IVs–4P

This unit consists of Lawther-Rhoades silty clays. These are moderately well drained to well drained, fine textured soils on fans and uplands. Some of the soils have a claypan subsoil. The organic-matter content is moderate, and natural fertility is low to high. The available water capacity is moderate to high, and permeability is very slow or slow. Surface runoff is slow.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are not well suited to row crops. They have poor tilth and are difficult to work.

Soil blowing, slow permeability, and a claypan subsoil in some of the soils are the main limitations. Wind stripcropping, stubble mulch tillage, using a rotation of grass and legumes, and use of crop residue help to maintain tilth and reduce erosion.

CAPABILITY UNIT IVs–6P

This unit consists of Morton-Rhoades silt loams, 6 to 9 percent slopes. These are moderately well drained and well drained, medium textured soils on uplands, fans, and terraces. Some of the soils in this unit have a claypan subsoil. The organic-matter content is moderate, and natural fertility is low to high. The available water capacity is moderate to high, and permeability is very slow to moderate. Surface runoff is slow to rapid.

These soils are suited to most crops commonly grown in the county. Wheat is the main crop. These soils are not well suited to row crops. They are easy to work and have good tilth except where the claypan is mixed with the plow layer.

Soil blowing, water erosion, and slow permeability in the claypan subsoil are the main limitations to the use of these soils. Diversions, waterways, stubble mulch tillage, conservation of crop residue, and including grass and legumes in the cropping system help to maintain tilth.

CAPABILITY UNIT Vw (WETLAND)

This unit consists of deep, nearly level soils. These are very poorly drained, fine textured soils in depressions, seeps, and drainageways. The organic-matter content is high, and natural fertility is medium. The available water capacity is moderate, and permeability is very slow. Surface runoff is ponded.

These soils are suited to hay and pasture. In many areas they are used for wildlife habitat.

Wetness is the main limitation to use of these soils. Grazing should be regulated to prevent animals from trampling the plants and causing puddling when the soils are wet. Drainage is not feasible on these soils.

CAPABILITY UNIT VIe (CLAYPAN)

This unit consists of the Sham complex, 1 to 9 per-

cent slopes. These are well drained, medium textured soils on fans and terraces. The organic-matter content is low, and natural fertility is medium. The available water capacity is moderate, and permeability is slow. Surface runoff is medium to rapid.

These soils are generally unsuited to cultivation. They are well suited to grazing. Water erosion is a serious hazard. Proper range use is needed.

CAPABILITY UNIT VIe (OVERFLOW)

This unit consists of Korchea and Havre soils, channeled. The soils are well drained and medium textured to moderately fine textured, and they are on bottom lands and terraces. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is moderate to high, and permeability is moderate. Surface runoff is slow.

These soils are generally unsuited to cultivation. They are well suited to grass. The areas are dissected by uncrossable stream channels, and the soils are highly susceptible to water erosion and deposition. Most areas are used for range or hay.

The soils in this unit are subject to flooding in spring and after heavy rain. A cover of vegetation helps to control runoff and erosion and maintain productivity. Proper range use is essential.

CAPABILITY UNIT VIe (SANDY)

This unit consists of shallow to deep, moderately sloping and strongly sloping soils. These are well drained to excessively drained, moderately coarse textured and coarse textured soils on uplands, terraces, and fans. Some of the soils in this unit have a claypan. The organic-matter content is low to moderate, and natural fertility is low to medium. The available water capacity is very low to moderate, and permeability is moderately rapid over slow to rapid. Permeability is slow in the soils that have a claypan. Surface runoff is medium.

These soils are generally unsuited to cultivation. They are well suited to native range or hay. These soils are droughty and are highly susceptible to soil blowing. If these soils are overgrazed, rapid deterioration will result. A good protective cover helps to control runoff and erosion and maintain productivity.

CAPABILITY UNIT VIe (SHALLOW)

This unit consists of shallow to moderately deep, gently sloping to strongly sloping soils. These are well drained to excessively drained and coarse textured, moderately coarse textured, and medium textured soils on uplands. The organic-matter content is low to moderate, and natural fertility is low to medium. The available water capacity is very low to moderate, and permeability is moderately slow to rapid. Surface runoff is slow to rapid.

These soils are generally unsuited to cultivation. They are well suited to native range or hay. These soils are droughty, steep, and shallow and are highly susceptible to soil blowing and water erosion. If these soils are overgrazed, rapid deterioration will result. A protective cover of vegetation helps to control runoff and erosion and maintain productivity.

CAPABILITY UNIT VIe (SHALLOW CLAY)

This unit consists of Wayden silty clay, 1 to 9 percent slopes. This is a well drained, fine textured soil on uplands. The organic-matter content and natural fertility are low. The available water capacity is low, and permeability is slow. Surface runoff is medium to rapid.

This soil is generally unsuited to cultivation. It is suited to native range. It is droughty and has a shallow root zone. Water erosion is a serious hazard. If this soil is overgrazed, rapid deterioration will result.

CAPABILITY UNIT VIe (SILTY)

This unit consists of Patent loam, 6 to 15 percent slopes. This is a well drained, medium textured soil on fans and foot slopes. The organic-matter content is moderately low, and natural fertility is medium. The available water capacity and permeability are moderate. Surface runoff is medium to rapid.

This soil is generally unsuited to cultivation. It is well suited to hay and native range. This soil is highly susceptible to water erosion and soil blowing. A protective cover of vegetation helps to control runoff and erosion and maintain fertility. Proper range use is essential. Deferred grazing is beneficial to this soil.

CAPABILITY UNIT VIs (CLOSED DEPRESSION)

This unit consists of Heil and McKenzie soils. These are poorly drained, medium textured to fine textured soils in depressions. The organic-matter content is moderate, and natural fertility is medium. The available water capacity is moderate, and permeability is very slow. Surface runoff is ponded.

These soils are generally unsuited to cultivation. They are wet, moderately saline, and alkaline. The claypan of the Heil soil limits penetration of roots, air, and moisture. These soils are best suited to native pasture and hay. Restricting grazing when the soil is wet prevents trampling of plants and puddling of the soil.

CAPABILITY UNIT VIs (CLAYPAN)

This unit consists of deep, nearly level to moderately sloping soils. These are moderately well drained and well drained, moderately coarse textured to moderately fine textured soils in swales and on fans, uplands, and foot slopes. The organic-matter content is moderate, and natural fertility is low to medium. The available water capacity is moderate, and permeability is slow to very slow. Surface runoff is slow to medium.

These soils are generally unsuited to cultivation because of extremely poor tilth and a dense, strongly alkaline claypan that limits the penetration of roots, air, and moisture. They are suited to native grasses for pasture and hay. A protective cover of vegetation reduces erosion and maintains productivity. Proper range use is essential.

CAPABILITY UNIT VIe (SANDS)

This unit consists of deep, nearly level to moderately sloping soils. These are well drained to excessively drained, coarse textured soils on terraces and uplands. The organic-matter content is very low to moderate, and natural fertility is low to medium. The available water capacity is low to moderate, and permeability is rapid. Surface runoff is very slow to slow.

These soils are generally unsuited to cultivation because of droughtiness and the hazard of soil blowing. They are well suited to native range or hay. If these soils are overgrazed, rapid deterioration will result. Grass should be established in blowout areas.

CAPABILITY UNIT VIs (SALINE LOWLAND)

This unit consists of Borolls, saline. The soils are saline seeps below uplands. They are too wet to cultivate during most of the growing season. The high water table has caused a high concentration of salts near the surface and throughout the root zone.

These soils are generally not suited to cultivation. Grass should be established for hay or grazing, and only salt-tolerant grasses should be seeded.

CAPABILITY UNIT VIs (THIN CLAYPAN)

This unit consists of deep, nearly level to moderately sloping soils. These are moderately well drained to well drained and medium textured, moderately fine textured, and fine textured soils in swales and on uplands, fans, and terraces. The organic-matter content is low to moderate, and natural fertility is low to medium. The available water capacity is moderate, and permeability is moderately slow to very slow. Surface runoff is ponded to rapid.

These soils are better suited to range or native grass pasture than to cultivated crops. Tilth is very poor.

Very slow permeability and a dense, strongly alkaline claypan that limits penetration of roots, air, and moisture are the main limitations. A protective cover reduces erosion and maintains productivity. Proper range use is essential. Range recovers slowly from overuse.

CAPABILITY UNIT VIe (THIN SANDS)

This unit consists of Hanly soils, 1 to 3 percent slopes. These are somewhat excessively drained, coarse textured and moderately coarse textured soils on bottom lands. The organic-matter content is moderate, and natural fertility is low. The available water capacity is low, and permeability is rapid. Surface runoff is slow.

These soils are generally not suited to cultivation because of droughtiness and the hazard of soil blowing. Flooding occurs in spring and after heavy rain. These soils are well suited to native range. Careful management is needed, because rapid deterioration of range will result from even a short period of overuse.

CAPABILITY UNIT VIs (VERY SHALLOW)

This unit consists of Wabek loam, 3 to 25 percent slopes. This is an excessively drained, medium textured soil on outwash plains and terraces. The organic-matter content is moderate, and natural fertility is low. The available water capacity is very low, and permeability is very rapid. Surface runoff is slow.

This soil is generally not suited to cultivation because of droughtiness, the hazard of soil blowing, and a shallow root zone. It is best suited to native range and hay. Proper range use is essential. Range recovers slowly from overuse.

CAPABILITY UNIT VIw (SALINE LOWLAND)

This unit consists of the Harriet complex. The soils making up this complex are poorly drained and medium textured. They are on bottom lands and in depressions. The organic-matter content is moderately low, and natural fertility is low. The available water capacity is moderate, and permeability is slow. Surface runoff is slow.

These soils generally are not suited to cultivation. They are a seasonal high water table, and in some places they are ponded for several weeks during the growing season. These soils are also saline. They are suited to native grasses for range and pasture.

CAPABILITY UNIT VIIe (SANDS)

This unit consists of Yetull loamy coarse sand, 6 to 25 percent slopes, which is a well drained soil on terraces and uplands. The organic-matter content and natural fertility are low. The available water capacity is very low, and permeability is rapid. Surface runoff is very slow to slow.

This soil generally is not suited to cultivation. It is very droughty and highly susceptible to soil blowing. This soil is suitable for use as native range land. Careful management is needed to prevent rapid deterioration of range that results from even a short period of overuse. Grass should be established in blowout areas.

CAPABILITY UNIT VIIs (SILTY)

This unit consists of Searing-Ringling stony loams, 3 to 6 percent slopes. These are well drained, medium textured soils on uplands. The organic-matter content is low to moderate, and natural fertility is low to medium. The available water capacity is very low to moderate, and permeability is moderate to rapid.

These soils are not suited to cultivated crops and hay because of stoniness and rockiness. They are well suited to native range. Proper range use is essential.

CAPABILITY UNIT VIIe (SHALLOW)

This unit consists of shallow, strongly sloping to very steep soils. These are well drained to excessively drained, coarse textured to medium textured soils on uplands. The organic-matter content and natural fertility are low. The available water capacity is very low to low, and permeability is moderate to rapid. Surface runoff is medium to very rapid.

These soils are generally unsuited to cultivation because of steep slopes and high susceptibility to erosion. They are suited to native range. Extreme care is necessary in management for grazing.

CAPABILITY UNIT VIIs (SHALLOW)

This unit consists of shallow and moderately deep, gently sloping to very steep soils. These are well drained to excessively drained, coarse textured to medium textured soils on uplands. Many stones are on the surface. The organic-matter content is low to moderate, and natural fertility is low to medium. The available water capacity is low to moderate, and permeability is moderately slow to moderate. Surface runoff is medium to very rapid.

These soils are too stony for cultivation. They are well suited to native range. Proper range use is essential.

CAPABILITY UNIT VIIe (SILTY)

This unit consists of Patent-Sham-Gullied land complex, 3 to 15 percent slopes. The soils in this complex are well drained and medium textured. They are on fans and terraces. Numerous gullies dissect the areas. The organic-matter content is low to moderately low, and natural fertility is medium. The available water capacity is moderate, and permeability is slow to moderate. Surface runoff is rapid.

The soils generally are not suited to cultivation. The hazard of erosion is severe. The soils are suited to native range. Proper range use is essential.

CAPABILITY UNIT VIIs (VERY SHALLOW)

This unit consists of Brandenburg-Cabba complex, 6 to 40 percent slopes. The soils are excessively drained and medium textured and are on uplands. The organic-matter content and natural fertility are low. The available water capacity is very low to low, and permeability is moderate to moderately rapid. Surface runoff is slow to very rapid.

These soils are generally unsuited to cultivation, because they are too steep and droughty and are shallow to scoria. Water erosion and soil blowing are serious hazards. These soils are suited to limited grazing. Proper range use is essential.

CAPABILITY UNIT VIIIe-1

This unit consists of Badland, mapping unit Bb, which is undergoing geologic erosion. Areas of Badland are not suited to grazing or cultivation. The slope is very steep, and the surface is mostly barren of vegetation.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 2. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 2.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 2 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Woodland [3]

Slope County has about 6,100 acres of native woodland. Most of the trees and shrubs grow on north-facing slopes, in drainageways, and bottom lands adjacent to main streams and rivers.

The main deciduous species are American plum, bearberry, big sagebrush, boxelder, common chokecherry, golden currant, green ash, plains cottonwood, poison-ivy, prairie rose, redosier dogwood, roundleaf hawthorn, Saskatoon serviceberry, shrubby cinquefoil, silver buffaloberry, silver sagebrush, skunkbush sumac, western snowberry, wildgrape, willow (shrub), Woods rose, and Virginia creeper.

The main coniferous species are creeping juniper, common juniper, Rocky Mountain juniper, and ponderosa pine. These conifers are mostly on Brandenburg, Cabbart, and Fleak soils in township 136 N. at ranges 102 W., 103 W., and 104 W. Other isolated stands occur throughout the western part of the county. Two unique stands of coniferous trees are in the county. One stand of columnar-shaped junipers is in an area known as the Burning Coal Vein. The other stand is made up of lumber pine and is located west of the Little Missouri River in the northwestern part of the county.

The early settlers used trees for building material, fence posts, and fuel. Today, native trees and shrubs are used mainly for livestock protection, wildlife, recreation, and watershed protection.

Windbreaks and Environmental Plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen

[3] DAVID L. HINTZ, forester, Soil Conservation Service, helped prepare this section.

TABLE 2.—*Yields per acre of crops and pasture*

[Yields are those that can be expected under a high level of management. The estimates were made in 1974. Absence of data indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Wheat, spring	Oats	Barley	Grass-legume hay
	Bu	*Bu*	*Bu*	*Ton*
Absher: AbA, AbC				
Amor:				
AgA	22	44	37	1.5
AgB	20	40	34	1.4
AgC	15	30	26	1.1
Arnegard: ArB	27	54	46	1.9
Badland: [1] BaF, Bb				
Belfield:				
BeA, BfA	20	40	34	1.4
BeB, BfB	19	38	32	1.3
[1] BhA	15	30	26	1.1
[1] BhB	12	24	20	0.9
Benz:				
BkC				
[1] BnC				
Borolls: Bo, [1] BrE				
Boxwell:				
BtB	18	36	31	1.3
BtC	13	26	22	1.0
Brandenburg: [1] BuE				
Cabba: CaE, [1] CbE, [1] CcD, [1] CdD				
Cabbart:				
CfC	7	14	14	0.5
CfD CfE, [1] CgE				
Chama:				
CmA	20	40	34	1.4
CmB	18	36	30	1.2
[1] CoB	15	30	26	1.1
[1] CoC	12	24	20	0.9
[1] CoD	8	16	14	0.6
[1] CrC	10	20	17	0.7
Chanta:				
CtA	13	26	22	1.0
CtB	11	22	19	0.8
Cherry: CyC	15	30	26	1.2
Chinook: CzB	15	30	25	1.1
Daglum:				
DaB	8	16	14	0.6
DaC, [1] DhB				

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Wheat, spring	Oats	Barley	Grass-legume hay
	Bu	*Bu*	*Bu*	*Ton*
Dimmick: Dk				
Ekalaka:				
[1] EdB	13	24	20	1.0
[1] EkB	11	22	19	0.9
[1] EkC				
Farland:				
FaA	22	44	37	1.5
FaB	20	40	34	1.4
Flasher: [1] FbE, [1] FhD, [1] FhE				
Fleak: [1]FkE, [1] FlD, [1] FlE				
Fluvaquentic Haplaquolls: Fu				
Glendive: GlA, GlB	15	30	25	1.1
Golva: GoC	19	38	32	1.3
Grail:				
GrA, GtA	27	54	46	1.9
GrB, GtB	24	48	41	1.8
Grassna:				
GwA	27	54	46	1.9
[1] GxB	24	48	41	1.8
Hanly: [1] HaA				
Harriet: [1] Hc				
Havre: HeA	22	44	37	1.5
Heil: [1] Hz				
Korchea:				
KcA	23	46	39	1.6
[1] Kh				
Kremlin: KrB, KrC	18	36	31	1.3
Lawther:				
LaA	24	48	41	1.8
LaB	22	44	37	1.5
[1] Lc	19	38	32	1.3
Lawther variant:				
LdA	18	36	30	1.2
LdC	14	28	24	0.9
Lefor:				
[1] LeB	15	30	26	1.1
[1] LeC	12	24	20	0.9
Manning:				
MaA	13	26	20	1.0
MaB	12	24	18	0.9

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Wheat, spring	Oats	Barley	Grass-legume hay
	Bu	*Bu*	*Bu*	*Ton*
Moreau:				
MeA	18	36	30	1.2
MeB	15	30	26	1.1
MeC	12	24	20	0.9
Morton:				
MoA, [1] MpA	23	48	39	1.6
MoB, [1] MpB	20	40	34	1.4
MoC, [1] MpC	15	30	26	1.1
[1] MrB	18	36	30	1.2
[1] MrC	12	24	20	0.9
Mott:				
MsA, MsB	19	38	32	1.4
MtA, MtB	21	43	35	1.5
Parshall: PaB	19	38	32	1.3
Patent:				
PeB	13	26	22	1.0
PeD				0.6
[1] PsD				
Reeder:				
ReA	22	44	37	1.5
ReB	20	40	34	1.4
ReC	15	30	26	1.1
Regent:				
RgA	22	44	37	1.5
RgB	20	40	34	1.4
[1] RhA	19	38	32	1.3
[1] RhC	15	30	26	1.1
Rhame:				
[1] RkB	13	26	22	1.0
[1] RkC	12	24	20	0.9
[1] RmC	10	20	17	0.7
[1] RmD				
Rhoades:				
[1] RsA				
[1] RsC				
[1] RxB				
Savage:				
SgA	23	46	39	1.6
SgB	20	40	44	1.4
[1] ShA	18	36	30	1.2

TABLE 2.—*Yields per acre of crops and pasture*—Continued

Soil name and map symbol	Wheat, spring	Oats	Barley	Grass-legume hay
	Bu	*Bu*	*Bu*	*Ton*
Searing:				
SlB	13	26	22	1.1
[1] SmB				
Sen:				
SnA	22	44	37	1.5
SnB	20	40	35	1.4
SnC, [1] SoC	15	30	26	1.1
[1] SoB	23	47	40	1.8
[1] SrD	9	18	15	0.7
Sham: [1] SsC				
Shambo:				
StA	22	44	37	1.5
StB	20	40	34	1.4
Stady:				
SyA	15	30	26	1.1
SyB	12	24	20	0.9
[1] SzC	9	18	15	0.7
Tally:				
TaA	18	36	30	1.2
TaB	17	35	29	1.1
Telfer:				
[1] TeB	11	22	19	0.8
[1] TeC				
Vebar:				
[1] VfC, [1] VrC	15	30	26	1.1
[1] VfD				
[1] VrB	18	36	30	1.2
Wabek: WaE				
Wayden: WyC				
Yetull: YeE				
Zeona: ZfC	7	14	14	0.5

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 3 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 3, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

TABLE 3.—*Windbreaks and environmental plantings*

[Dashes mean that trees generally do not grow to the given height on that soil. Only those mapping units and parts of mapping units that are suitable for trees and plants are rated]

Soil name and map symbol	Trees and plants having a predicted 20-year average height, in feet, of—				
	Less than 8	8 to 15	16 to 25	26 to 35	More than 35
Amor: AgA, AgB, AgC	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.		
Arnegard: ArB		Eastern redcedar, Rocky Mt. juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
Belfield: BeA, BeB, BfA, BfB, [1] BhA, [1] BhB. (Rhoades part of BhA and BhB not rated.)	Tatarian honeysuckle, American plum.	American elm, ponderosa pine, Rocky Mt. juniper, Russian-olive, Siberian peashrub, common chokecherry.	Siberian elm, green ash.		
Boxwell: BtB, BtC	Siberian peashrub, Tatarian honeysuckle, American plum.	Russian-olive, eastern redcedar, Rocky Mt. juniper, common chokecherry.	Siberian elm, green ash, ponderosa pine, Black Hills spruce.		
Cabba: [1] CcD, [1] CdD (Ratings are for Chama part. Cabba part was not rated.)	Eastern redcedar, Rocky Mt. juniper, Siberian peashrub.	Siberian elm, green ash, ponderosa pine.			
Chama: CmA, CmB, [1] CoB, [1] CoC, [1] CoD, [1] CrC. (Cabba part of CoB, CoC, and CoD and Cabbart part of CrC not rated.)	Eastern redcedar, Rocky Mt. juniper, Siberian peashrub.	Siberian elm, green ash, ponderosa pine.			
Chanta: CtA, CtB	Rocky Mt. juniper, Siberian peashrub, eastern redcedar.	Green ash, ponderosa pine, Russian-olive.	Siberian elm		
Cherry: CyC	Siberian peashrub, Tatarian honeysuckle, American plum.	Blue spruce, common chokecherry, Rocky Mt. juniper.	American elm, green ash, ponderosa pine, Russian-olive.	Siberian elm	Plains cottonwood.
Chinook: CzB		Siberian peashrub, eastern redcedar, Rocky Mt. juniper, common chokecherry, Tatarian honeysuckle, American plum.	Siberian elm, ponderosa pine.		
Dimmick: Dk		Eastern redcedar, Siberian peashrub, Tatarian honeysuckle.	Green ash, American elm, Russian-olive.	Siberian elm	Eastern cottonwood.

TABLE 3.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees and plants having a predicted 20-year average height, in feet, of—				
	Less than 8	8 to 15	16 to 25	26 to 35	More than 35
Farland: FaA, FaB	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, American plum.	Siberian elm, American elm, green ash, blue spruce, ponderosa pine.		
Glendive: GlA, GlB		Siberian peashrub, eastern redcedar, Rocky Mt. juniper, common chokecherry, Tatarian honeysuckle, American plum.	Siberian elm, ponderosa pine.		
Golva: GoC		Siberian peashrub, common chokecherry, Rocky Mt. juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce, Russian-olive.	Siberian elm	
Grail: GrA, GrB, GtA, GtB.		Eastern redcedar, Rocky Mt. juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
Grassna: GwA, [1]GxB		Eastern redcedar, Rocky Mt. juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.
Golva part of GxB		Siberian peashrub, common chokecherry, Rocky Mt. juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce, Russian-olive.	Siberian elm	
Havre: HeA		Common chokecherry, Rocky Mt. juniper, Russian-olive, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, blue spruce, ponderosa pine, green ash.	Siberian elm	Eastern cottonwood.
Korchea: KcA, [1]Kh		Common chokecherry, Rocky Mt. juniper, Russian-olive, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, blue spruce, ponderosa pine, green ash.	Siberian elm	Eastern cottonwood.
Kremlin: KrB, KrC		Eastern redcedar, Rocky Mt. juniper, Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	Eastern cottonwood.

TABLE 3.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees and plants having a predicted 20-year average height, in feet, of—				
	Less than 8	8 to 15	16 to 25	26 to 35	More than 35
Lawther: LaA, LaB, [1] Lc. (Rhoades part of Lc not rated.)	Tatarian honeysuckle.	American elm, ponderosa pine, Rocky Mt. juniper, Russian-olive, Siberian peashrub, common chokecherry, American plum.	Siberian elm, green ash.		
Lawther variant: LdA, LdC	Siberian peashrub, eastern redcedar, Rocky Mt. juniper.	Green ash, ponderosa pine, Russian-olive.	Siberian elm		
Lefor: [1] LeB, [1] LeC: Lefor part		Siberian peashrub, eastern redcedar, Rocky Mt. juniper, common chokecherry, Tatarian honeysuckle, American plum.	Siberian elm, ponderosa pine, American elm, green ash, Russian-olive.		
Vebar part		American elm, green ash, Siberian peashrub, eastern redcedar, common chokecherry, American plum.	Siberian elm, ponderosa pine.		
Manning: MaA, MaB	Siberian peashrub, eastern redcedar, Rocky Mt. juniper.	Green ash, ponderosa pine, Russian-olive.	Siberian elm		
Moreau: MeA, MeB, MeC		Eastern redcedar, Rocky Mt. juniper, Russian-olive, Siberian peashrub, common chokecherry, Tatarian honeysuckle, American plum.	Siberian elm, green ash, American elm, ponderosa pine.		
Morton: MoA, MoB, MoC, [1] MpA, [1] MpB, [1] MpC, [1] MrB, [1] MrC. (Rhoades part of MrB and MrC not rated.)		Russian-olive, Siberian peashrub, common chokecherry, eastern redcedar, Rocky Mt. juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, blue spruce.	Siberian elm	
Mott: MsA, MsB, MtA, MtB.	Common chokecherry, Tatarian honeysuckle, American plum.	Green ash, Russian-olive, Siberian peashrub, eastern redcedar, Rocky Mt. juniper.	Siberian elm, ponderosa pine.		
Parshall: PaB		Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, blue spruce, green ash, ponderosa pine, common chokecherry, Rocky Mt. juniper, Russian-olive.	Siberian elm	Eastern cottonwood.

TABLE 3.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees and plants having a predicted 20-year average height, in feet, of—				
	Less than 8	8 to 15	16 to 25	26 to 35	More than 35
Patent: PeB, PeD, [1] PsD. (Sham and Gullied land parts of PsD not rated.)		Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	
Reeder: ReA, ReB, ReC		Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, Tatarian honeysuckle, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.		
Regent: RgA, RgB, [1] RhA, [1] RhC. (Rhoades part of RhA and RhC not rated.)		Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, Tatarian honeysuckle.	Siberian elm, American elm, green ash.		
Rhame: [1] RkB, [1] RkC, [1] RmC, [1] RmD. (Fleak part of RmC and RmD not rated.)		Siberian peashrub, eastern redcedar, Rocky Mt. juniper, common chokecherry, Tatarian honeysuckle, American plum.	Siberian elm, ponderosa pine, American elm, green ash, Russian-olive.		
Rhoades: [1] RsA, [1] RsC (Ratings are for Belfield part. Rhoades part was not rated.)	Tatarian honeysuckle, American plum.	American elm, ponderosa pine, Rocky Mt. juniper, Russian-olive, Siberian peashrub, common chokecherry.	Siberian elm, green ash.		
Savage: SgA, SgB, [1] ShA (Rhoades part of ShA not rated.)	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, American plum.	Siberian elm, American elm, green ash, blue spruce, ponderosa pine.		
Searing: SlB, [1] SmB (Ringling part of SmB not rated.)	Common chokecherry, Tatarian honeysuckle, American plum.	American elm, green ash, Russian-olive, Siberian peashrub, Rocky Mt. juniper.	Siberian elm, ponderosa pine.		
Sen: SnA, SnB, SnC, [1] SoB, [1] SoC, [1] SrD.	Tatarian honeysuckle.	Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, American plum.	Siberian elm, American elm, green ash, ponderosa pine, blue spruce.		
Golva part of SoB and SoC		Siberian peashrub, common chokecherry, Rocky Mt. juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce, Russian-olive.	Siberian elm	

TABLE 3.—*Windbreaks and environmental plantings*—Continued

Soil name and map symbol	Trees and plants having a predicted 20-year average height, in feet, of—				
	Less than 8	8 to 15	16 to 25	26 to 35	More than 35
Shambo: StA, StB		Russian-olive, Siberian peashrub, common chokecherry, Rocky Mt. juniper, Tatarian honeysuckle, American plum.	American elm, green ash, ponderosa pine, Black Hills spruce, blue spruce.	Siberian elm	
Stady: SyA, SyB, [1] SzC.	Eastern redcedar, Siberian peashrub, Rocky Mt. juniper.	Ponderosa pine, Russian-olive, green ash.	Siberian elm		
Tally: TaA, TaB		Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, blue spruce, green ash, ponderosa pine, common chokecherry, Rocky Mt. juniper, Russian-olive.	Siberian elm	Eastern cottonwood.
Telfer: [1] TeB, [1] TeC		Ponderosa pine, eastern redcedar, Rocky Mt. juniper.			
Vebar: [1] VfC, [1] VfD, [1] VrB, [1] VrC. (Flasher part of VfC and VfD not rated.)		American elm, green ash, Siberian peashrub, eastern redcedar, common chokecherry, American plum.	Siberian elm, ponderosa pine.		
Tally part of VrB and VrC		Siberian peashrub, Tatarian honeysuckle, American plum.	American elm, blue spruce, green ash, ponderosa pine, common chokecherry, Rocky Mt. juniper, Russian-olive.	Siberian elm	Eastern cottonwood.

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

Range

About 59 percent of Slope County is rangeland. About half of the agricultural income is derived from livestock, principally cattle. Cow-calf operations are the dominant livestock enterprise.

On many ranches, crop stubble and small grain are used to supplement the forage produced on rangeland. If winter grazing is practiced, a protein concentrate is commonly used to supplement native forage. Creep feeding of calves and yearlings is practiced on some ranches.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 4 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 4.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant

TABLE 4.—*Range productivity and composition*

[Soils not listed are not in a range site; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Absher: AbA, AbC	Thin claypan	Favorable	750	Western wheatgrass	25
		Normal	550	Blue grama	35
		Unfavorable	300	Prairie junegrass	5
				Sandberg bluegrass	5
				Buffalo grass	5
Amor: AgA, AgB, AgC	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	1,950	Needleandthread	15
		Unfavorable	1,600	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Arnegard: ArB	Silty	Favorable	2,550	Western wheatgrass	25
		Normal	2,150	Needleandthread	15
		Unfavorable	1,750	Blue grama	13
				Green needlegrass	10
				Kentucky bluegrass	5
Badland: [1] BaF (Cabbart part). (Badland part not rated.)	Shallow	Favorable	1,400	Needleandthread	15
		Normal	1,150	Little bluestem	20
		Unfavorable	900	Prairie sandreed	10
				Western wheatgrass	10
				Blue grama	10
				Plains muhly	5
				Threadleaf sedge	7
Belfield: BeA, BeB, BfA, BfB, [1] BhA, [1] BhB.	Clayey	Favorable	2,350	Western wheatgrass	40
		Normal	1,900	Green needlegrass	10
		Unfavorable	1,450	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5
Rhoades part of BhA and BhB.	Thin claypan	Favorable	800	Blue grama	35
		Normal	600	Western wheatgrass	30
		Unfavorable	400	Sandberg bluegrass	5
				Prairie junegrass	5
				Buffalo grass	5
Benz: BkC, [1] BnC	Thin claypan	Favorable	700	Western wheatgrass	30
		Normal	500	Nuttal saltbrush	8
		Unfavorable	300	Alkali sacaton	5
				Plains reedgrass	5
				Needleandthread	5
				Inland saltgrass	5
				Sandberg bluegrass	5
				Black greasewood	5
Absher part of BnC	Thin claypan	Favorable	750	Western wheatgrass	25
		Normal	550	Blue grama	35
		Unfavorable	300	Prairie junegrass	5
				Sandberg bluegrass	5
				Buffalo grass	5
Borolls: Bo	Saline lowland	Favorable	2,600	Nuttall alkaligrass	15
		Normal	2,200	Western wheatgrass	35
		Unfavorable	1,800	Slender wheatgrass	5
				Inland saltgrass	20
[1] BrE	Shallow	Favorable	1,450	Little bluestem	25
		Normal	1,200	Prairie sandreed	10
		Unfavorable	950	Needleandthread	10
				Threadleaf sedge	8
				Plains muhly	5
				Western wheatgrass	5
				Blue grama	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Boxwell: BtB, BtC	Silty	Favorable	1,850	Western wheatgrass	35
		Normal	1,600	Blue grama	20
		Unfavorable	1,350	Needleandthread	10
				Green needlegrass	5
				Prairie junegrass	5
Brandenburg: [1] BuE:					
Brandenburg part	Very shallow	Favorable	750	Western wheatgrass	15
		Normal	600	Blue grama	15
		Unfavorable	350	Needleandthread	10
				Little bluestem	10
				Bluebunch wheatgrass	5
				Prairie junegrass	5
				Red threeawn	5
				Plains muhly	5
Cabba part	Shallow	Favorable	1,450	Needleandthread	15
		Normal	1,200	Little bluestem	20
		Unfavorable	900	Prairie sandreed	10
				Western wheatgrass	10
				Blue grama	10
				Plains muhly	5
				Threadleaf sedge	7
Cabba: CaE, [1] CbE, [1] CcD, [1] CdD. (Badland part of CbE not rated.)	Shallow	Favorable	1,450	Needleandthread	15
		Normal	1,200	Little bluestem	20
		Unfavorable	900	Prairie sandreed	10
				Western wheatgrass	10
				Blue grama	10
				Plains muhly	5
				Threadleaf sedge	7
Chama part of CcD and CdD.	Silty	Favorable	2,000	Western wheatgrass	35
		Normal	1,650	Blue grama	20
		Unfavorable	1,200	Needleandthread	10
				Green needlegrass	5
				Prairie junegrass	5
Cabbart: CfC, CfD, CfE, [1] CgE. (Badland part of CgE not rated.)	Shallow	Favorable	1,400	Needleandthread	15
		Normal	1,150	Little bluestem	20
		Unfavorable	900	Prairie sandreed	10
				Western wheatgrass	10
				Blue grama	10
				Plains muhly	5
				Threadleaf sedge	7
Chama: CmA, CmB, [1] CoB, [1] CoC, [1] CoD, [1] CrC.	Silty	Favorable	2,000	Western wheatgrass	35
		Normal	1,200	Blue grama	20
		Unfavorable	900	Needleandthread	10
				Green needlegrass	5
				Prairie junegrass	5
Cabba part of CoB, CoC, and CoD.	Shallow	Favorable	1,450	Needleandthread	15
		Normal	1,200	Little bluestem	20
		Unfavorable	900	Prairie sandreed	10
				Western wheatgrass	10
				Blue grama	10
				Plains muhly	5
				Threadleaf sedge	7
Cabbart part of CrC	Shallow	Favorable	1,400	Needleandthread	15
		Normal	1,150	Little bluestem	20
		Unfavorable	900	Prairie sandreed	10
				Western wheatgrass	10
				Blue grama	10
				Plains muhly	5
				Threadleaf sedge	7

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Chanta: CtA, CtB	Silty	Favorable	1,850	Western wheatgrass	35
		Normal	1,550	Blue grama	20
		Unfavorable	1,250	Needleandthread	10
				Green needlegrass	5
				Prairie junegrass	5
Cherry: CyC	Silty	Favorable	2,150	Western wheatgrass	25
		Normal	1,750	Needleandthread	15
		Unfavorable	1,350	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Chinook: CzB	Sandy	Favorable	2,000	Needleandthread	25
		Normal	1,750	Western wheatgrass	10
		Unfavorable	1,450	Prairie sandreed	15
				Blue grama	15
				Prairie junegrass	5
				Penn sedge	5
Daglum: DaB, DaC, [1] DhB	Claypan	Favorable	1,750	Western wheatgrass	30
		Normal	1,400	Blue grama	25
		Unfavorable	1,050	Needleandthread	10
				Prairie junegrass	5
Rhoades part of DhB	Thin claypan	Favorable	800	Blue grama	35
		Normal	600	Western wheatgrass	30
		Unfavorable	400	Sandberg bluegrass	5
				Prairie junegrass	5
				Buffalo grass	5
Dimmick: Dk	Wetland	Favorable	5,650	Slough sedge	60
		Normal	5,200	Prairie cordgrass	5
		Unfavorable	4,750	Slim sedge	5
Ekalaka: [1] EdB, [1] EkB, [1] EkC.	Sandy	Favorable	2,100	Prairie sandreed	20
		Normal	1,750	Needleandthread	20
		Unfavorable	1,400	Western wheatgrass	10
				Blue grama	10
				Prairie junegrass	5
Desart part of EdB	Sandy	Favorable	2,200	Prairie sandreed	20
		Normal	1,850	Needleandthread	20
		Unfavorable	1,500	Western wheatgrass	10
				Blue grama	10
				Prairie junegrass	5
Farland: FaA, FaB	Silty	Favorable	2,250	Western wheatgrass	25
		Normal	1,900	Needleandthread	15
		Unfavorable	1,550	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Flasher: [1] FbE, [1] FhD, [1] FhE. (Badland part of FbE not rated.)	Shallow	Favorable	1,700	Little bluestem	25
		Normal	1,400	Prairie sandreed	10
		Unfavorable	1,100	Needleandthread	10
				Threadleaf sedge	8
				Plains muhly	5
				Western wheatgrass	5
				Blue grama	5
Fleak: [1] FkE, [1] FlD, [1] FlE. (Badland part of FkE not rated.)	Shallow	Favorable	1,450	Little bluestem	25
		Normal	1,100	Needleandthread	15
		Unfavorable	750	Prairie sandreed	10
				Threadleaf sedge	8
				Plains muhly	5
				Blue grama	5
				Sideoats grama	5
				Western wheatgrass	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Fluvaquentic Haplaquolls:					
Fu	Wetland	Favorable	4,000	Prairie cordgrass	25
		Normal	3,500	Slim sedge	25
		Unfavorable	3,000	Fescue sedge	10
				Baltic rush	5
				Northern reedgrass	5
				Switchgrass	5
				Fowl bluegrass	5
Glendive:					
GlA	Overflow	Favorable	2,650	Western wheatgrass	25
		Normal	2,300	Green needlegrass	20
		Unfavorable	1,950	Needleandthread	10
				Big bluestem	10
				Blue grama	5
GlB	Sandy	Favorable	2,100	Needleandthread	25
		Normal	1,800	Western wheatgrass	10
		Unfavorable	1,500	Prairie sandreed	15
				Blue grama	15
				Prairie junegrass	5
				Penn sedge	5
Golva: GoC	Silty	Favorable	2,350	Western wheatgrass	25
		Normal	2,000	Needleandthread	15
		Unfavorable	1,650	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Grail:					
GrA, GtA	Overflow	Favorable	2,700	Big bluestem	20
		Normal	2,450	Green needlegrass	15
		Unfavorable	2,100	Western wheatgrass	20
				Needleandthread	5
				Blue grama	5
GrB, GtB	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	2,000	Needleandthread	15
		Unfavorable	1,700	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Grassna:					
GwA	Overflow	Favorable	2,700	Big bluestem	20
		Normal	2,450	Green needlegrass	15
		Unfavorable	2,100	Western wheatgrass	20
				Needleandthread	5
				Blue grama	5
[1] GxB:					
Grassna part	Silty	Favorable	2,400	Western wheatgrass	25
		Normal	2,100	Needleandthread	15
		Unfavorable	1,800	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Golva part	Silty	Favorable	2,350	Western wheatgrass	25
		Normal	2,000	Needleandthread	15
		Unfavorable	1,650	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Hanly: [1] HaA	Thin sands	Favorable	1,700	Needleandthread	30
		Normal	1,400	Prairie sandreed	15
		Unfavorable	1,100	Blue grama	10
				Western wheatgrass	5
				Sand dropseed	5
				Penn sedge	5
Harriet: [1] Hc	Saline lowland	Favorable	2,600	Western wheatgrass	35
		Normal	2,200	Inland saltgrass	20
		Unfavorable	1,800	Nuttall alkaligrass	15
				Slender wheatgrass	5
Havre: HeA	Overflow	Favorable	2,650	Western wheatgrass	25
		Normal	2,300	Green needlegrass	20
		Unfavorable	1,950	Needleandthread	10
				Big bluestem	10
				Blue grama	5
Heil: [1] Hz:					
Heil part	Closed depression	Favorable	2,800	Western wheatgrass	50
		Normal	2,400	Prairie cordgrass	10
		Unfavorable	2,000	Fowl bluegrass	5
				Common spikesedge	5
				Curled dock	5
McKenzie part	Closed depression	Favorable	2,850	Western wheatgrass	50
		Normal	2,500	Prairie cordgrass	10
		Unfavorable	2,150	Fowl bluegrass	5
				Common spikesedge	5
				Curled dock	5
Korchea:					
KcA	Overflow	Favorable	2,900	Big bluestem	20
		Normal	2,500	Western wheatgrass	20
		Unfavorable	2,100	Green needlegrass	15
				Needleandthread	7
				Blue grama	5
				Kentucky bluegrass	5
[1] Kh	Overflow	Favorable	2,650	Western wheatgrass	25
		Normal	2,300	Green needlegrass	20
		Unfavorable	1,950	Needleandthread	10
				Big bluestem	10
				Blue grama	5
Kremlin: KrB, KrC	Silty	Favorable	2,000	Western wheatgrass	35
		Normal	1,750	Blue grama	20
		Unfavorable	1,450	Needleandthread	10
				Green needlegrass	5
				Prairie junegrass	5
Lawther:					
LaA, LaB, [1] Lc	Clayey	Favorable	2,100	Western wheatgrass	40
		Normal	1,750	Green needlegrass	10
		Unfavorable	1,400	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5
Rhoades part of Lc	Thin claypan	Favorable	800	Blue grama	35
		Normal	600	Western wheatgrass	30
		Unfavorable	400	Sandberg bluegrass	5
				Prairie junegrass	5
				Buffalo grass	5
Lawther variant:					
LdA, LdC	Clayey	Favorable	2,100	Western wheatgrass	40
		Normal	1,750	Green needlegrass	10
		Unfavorable	1,400	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Lefor: [1] LeB, [1] LeC:					
Lefor part	Sandy	Favorable	2,400	Prairie sandreed	20
		Normal	2,150	Needleandthread	20
		Unfavorable	1,850	Western wheatgrass	10
				Blue grama	10
				Prairie junegrass	5
Vebar part	Sandy	Favorable	2,300	Needleandthread	20
		Normal	2,000	Prairie sandreed	20
		Unfavorable	1,700	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
Manning: MaA, MaB	Sandy	Favorable	2,150	Needleandthread	20
		Normal	1,800	Prairie sandreed	20
		Unfavorable	1,450	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
				Sand dropseed	2
				Silverleaf scurfpea	2
				Gray sagewort	2
				Leadplant	2
				Other perennial forbs	6
				Other perennial grasslike plants.	4
				Other perennial grasses	3
				Other shrubs	3
Moreau: MeA, MeB, MeC	Clayey	Favorable	2,050	Western wheatgrass	40
		Normal	1,700	Green needlegrass	10
		Unfavorable	1,350	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5
Morton: MoA, MoB, MoC, [1] MpA, [1] MpB, [1] MpC, [1] MrB, [1] MrC.	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	1,900	Needleandthread	15
		Unfavorable	1,500	Blue grama	13
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Rhoades part of MrB and MrC.	Thin claypan	Favorable	650	Blue grama	35
		Normal	450	Western wheatgrass	30
		Unfavorable	250	Sandberg bluegrass	5
				Prairie junegrass	5
				Buffalo grass	5
Mott: MsA, MsB	Sandy	Favorable	2,150	Needleandthread	20
		Normal	1,800	Prairie sandreed	20
		Unfavorable	1,450	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
				Other perennial forbs	6
MtA, MtB	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	1,950	Needleandthread	15
		Unfavorable	1,600	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Parshall: PaB	Sandy	Favorable	2,300	Needleandthread	20
		Normal	2,000	Prairie sandreed	20
		Unfavorable	1,700	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
Patent: PeB, PeD, [1] PsD (Gullied land part of PsD not rated.)	Silty	Favorable	1,950	Western wheatgrass	35
		Normal	1,700	Blue grama	20
		Unfavorable	1,450	Needleandthread	10
				Green needlegrass	5
				Prairie junegrass	5
Sham part of PsD	Claypan	Favorable	1,600	Western wheatgrass	25
		Normal	1,300	Blue grama	25
		Unfavorable	1,000	Needleandthread	10
				Prairie junegrass	5
				Slender wheatgrass	5
				Sandberg bluegrass	5
Reeder: ReA, ReB, ReC	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	1,900	Needleandthread	15
		Unfavorable	1,500	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Regent: RgA, RgB, [1] RhA, [1] RhC	Clayey	Favorable	2,150	Western wheatgrass	40
		Normal	1,800	Green needlegrass	10
		Unfavorable	1,450	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5
Rhoades part of RhA and RhC.	Thin claypan	Favorable	800	Blue grama	35
		Normal	600	Western wheatgrass	30
		Unfavorable	400	Sandberg bluegrass	5
				Prairie junegrass	5
				Buffalo grass	5
Rhame: [1] RkB, [1] RkC, [1] RmC, [1] RmD.	Sandy	Favorable	2,050	Needleandthread	25
		Normal	1,700	Prairie sandreed	15
		Unfavorable	1,350	Blue grama	15
				Western wheatgrass	10
				Prairie junegrass	5
				Penn sedge	5
Chinook part of RkB and RkC.	Sandy	Favorable	2,000	Needleandthread	25
		Normal	1,750	Western wheatgrass	10
		Unfavorable	1,450	Prairie sandreed	15
				Blue grama	15
				Prairie junegrass	5
				Sand dropseed	2
				Penn sedge	5
Fleak part of RmC and RmD.	Shallow	Favorable	1,450	Little bluestem	25
		Normal	1,100	Needleandthread	15
		Unfavorable	750	Prairie sandreed	10
				Threadleaf sedge	8
				Plains muhly	5
				Blue grama	5
				Sideoats gramma	5
				Western wheatgrass	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Rhoades: [1] RsA, [1] RsC, [1] RxB	Thin claypan	Favorable	800	Blue grama	35
		Normal	600	Western wheatgrass	30
		Unfavorable	400	Sandberg bluegrass	5
				Prairie junegrass	5
				Buffalo grass	5
Belfield part of RsA and RsC.	Clayey	Favorable	2,350	Western wheatgrass	40
		Normal	1,900	Green needlegrass	10
		Unfavorable	1,450	Blue grama	10
				Prairie junegrass	5
				Plains reedgrass	5
Savage: SgA, SgB, [1] ShA	Clayey	Favorable	1,950	Western wheatgrass	45
		Normal	1,700	Blue grama	15
		Unfavorable	1,450	Green needlegrass	5
				Prairie junegrass	5
				Plains reedgrass	5
				Buffalo grass	5
Rhoades part of ShA	Thin claypan	Favorable	750	Blue grama	35
		Normal	550	Western wheatgrass	30
		Unfavorable	350	Sandberg bluegrass	5
				Prairie junegrass	5
				Buffalo grass	5
Searing: SlB, [1] SmB	Silty	Favorable	2,150	Western wheatgrass	25
		Normal	1,750	Needleandthread	15
		Unfavorable	1,300	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Ringling part of SmB	Very shallow	Favorable	750	Western wheatgrass	15
		Normal	600	Blue grama	15
		Unfavorable	350	Needleandthread	10
				Little bluestem	10
				Bluebunch wheatgrass	5
				Prairie junegrass	5
				Red threeawn	5
				Plains muhly	5
Sen: SnA, SnB, SnC, [1] SoB, [1] SoC, [1] SrD	Silty	Favorable	2,150	Western wheatgrass	25
		Normal	1,800	Needleandthread	15
		Unfavorable	1,450	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Golva part of SoB and SoC.	Silty	Favorable	2,350	Western wheatgrass	25
		Normal	2,000	Needleandthread	15
		Unfavorable	1,650	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Amor part of SrD	Silty	Favorable	2,300	Western wheatgrass	25
		Normal	1,950	Needleandthread	15
		Unfavorable	1,600	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Sham: [1] SsC	Claypan	Favorable	1,600	Western wheatgrass	25
		Normal	1,300	Blue grama	25
		Unfavorable	1,000	Needleandthread	5
				Prairie junegrass	5
				Slender wheatgrass	5
				Sandberg bluegrass	5
Shambo: StA, StB	Silty	Favorable	2,350	Western wheatgrass	25
		Normal	2,000	Needleandthread	15
		Unfavorable	1,650	Blue grama	15
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Stady:					
SyA, SyB, [1] SzC	Silty	Favorable	2,000	Western wheatgrass	25
		Normal	1,700	Needleandthread	15
		Unfavorable	1,400	Blue grama	13
				Green needlegrass	7
				Prairie junegrass	5
				Kentucky bluegrass	5
Manning part of SzC	Sandy	Favorable	2,150	Needleandthread	20
		Normal	1,800	Prairie sandreed	20
		Unfavorable	1,450	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
Tally: TaA, TaB	Sandy	Favorable	2,300	Needleandthread	20
		Normal	2,000	Prairie sandreed	20
		Unfavorable	1,700	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
Telfer: [1] TeB, [1] TeC:					
Telfer part	Sands	Favorable	2,100	Needleandthread	25
		Normal	1,800	Prairie sandreed	20
		Unfavorable	1,500	Blue grama	10
				Western wheatgrass	5
				Sand dropseed	5
				Sand bluestem	5
				Penn sedge	5
Lihen part	Sands	Favorable	2,200	Needleandthread	25
		Normal	1,900	Prairie sandreed	20
		Unfavorable	1,600	Blue grama	10
				Western wheatgrass	5
				Sand dropseed	5
				Sand bluestem	5
				Penn sedge	5
Vebar: [1] VfC, [1] VfD, [1] VrB, [1] VrC.	Sandy	Favorable	2,300	Needleandthread	20
		Normal	2,000	Prairie sandreed	20
		Unfavorable	1,700	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
Flasher part of VfC and VfD.	Shallow	Favorable	1,700	Little bluestem	25
		Normal	1,400	Prairie sandreed	10
		Unfavorable	1,100	Needleandthread	10
				Threadleaf sedge	8
				Plains muhly	5
				Western wheatgrass	5
				Blue grama	5

TABLE 4.—*Range productivity and composition*—Continued

Soil name and map symbol	Range site	Potential production		Common plants	Composition
		Kind of year	Dry weight		
			Lb per acre		*Pct*
Tally part of VrB and VrC.	Sandy	Favorable	2,300	Needleandthread	20
		Normal	2,000	Prairie sandreed	20
		Unfavorable	1,700	Blue grama	10
				Western wheatgrass	10
				Penn sedge	6
				Prairie junegrass	5
				Green needlegrass	5
Wabek: WaE	Very shallow	Favorable	800	Needleandthread	25
		Normal	700	Blue grama	15
		Unfavorable	600	Western wheatgrass	15
				Threadleaf sedge	8
				Plains muhly	5
				Prairie junegrass	5
				Red threeawn	5
Wayden: WyC	Shallow clay	Favorable	1,200	Western wheatgrass	50
		Normal	1,000	Green needlegrass	5
		Unfavorable	800	Blue grama	5
				Plains muhly	5
				Sandberg bluegrass	5
Yetull: YeE	Sands	Favorable	1,400	Needleandthread	30
		Normal	1,200	Prairie sandreed	15
		Unfavorable	1,000	Western wheatgrass	5
				Sand dropseed	5
				Blue grama	5
				Penn sedge	10
Zeona: ZfC	Sands	Favorable	1,400	Needleandthread	30
		Normal	1,200	Prairie sandreed	15
		Unfavorable	1,000	Western wheatgrass	5
				Sand dropseed	5
				Blue grama	5
				Penn sedge	10

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Common plants are those grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. Because only major species are listed, the percentages do not necessarily total 100. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants

growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Most of the range in the survey area is in the western part. Most of the soils are shallow over soft shale or sandstone beds, and large areas of nearly barren Badland are common. The soils support short grasses, and potential production is low because of a shallow root zone.

The major management concern in most range areas is control of grazing to reestablish the potential plant community (fig. 11). Controlling brush and reducing soil blowing and erosion are also important management concerns. If good range management based on survey information and range inventories is applied, the productivity of range in the area can be increased.

Wildlife Habitat [4]

Wildlife and fisheries resources are significant in the outdoor recreation activities available to people in Slope County. These resources also contribute to the county's economy.

Wildlife numbers have been reduced substantially since the county was settled. The bird population is about the same as at that time, but a number of mammal species are no longer present. Three bird species—gray partridge, Merriams turkey, and ring-necked pheasant—have been introduced and are now resident in the area. Several rare and endangered species nest in the county: the prairie falcon, the peregrine falcon, and the pigeon hawk. A very small number of golden eagles nest in the county.

Birds and mammals in Slope County include duck, pheasant, gray (Hungarian) partridge, sharp-tailed grouse, sage grouse, white-tailed deer, mule deer, antelope, mourning dove, cottontail, and fox squirrel. Red fox, mink, beaver, coyote, and jackrabbit are important furbearers.

The Little Missouri River and manmade reservoirs—Cedar Lake, Davis Dam, and Hamann Dam—provide public fishing in the county. The Little Missouri River yields goldeye, northern pike, sauger, bullhead, walleye, and catfish. River fishing is seasonal; the number of fish depends somewhat on the volume of river flow.

The county has a fair potential for the construction of additional dams for fisheries.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 5, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature

[4] ERLING B. PODOLL, biologist, Soil Conservation Service, Bismarck, North Dakota, helped prepare this section.

Figure 11.—This Shallow range site is excellent for wildlife habitat. Native plants include little bluestem, prairie sandreed, and black samson.

TABLE 5.—*Wildlife*

[See text for definitions of "good," "fair," "poor," and "very

Soil name and map symbol	Potential for habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Absher: AbA, AbC	Poor	Poor	Very poor
Amor: AgA, AgB, AgC	Good	Good	Good
Arnegard: ArB	Good	Good	Good
Badland:			
[1] BaF (Cabbart part) (Badland part too variable to be rated.)	Very poor	Very poor	Fair
Bb. (Too variable to be rated.)			
Belfield:			
BeA, BeB, BfA, BfB, [1] BhA, [1] BhB	Fair	Good	Fair
Rhoades part of BhA and BhB	Poor	Poor	Poor
Benz: BkC, [1] BnC	Poor	Poor	Very poor
Absher part of BnC	Poor	Poor	Very poor
Borolls: Bo.			
[1] BrE	Very poor	Very poor	Poor
Boxwell: BtB, BtC	Fair	Good	Fair
Brandenburg: [1] BuE:			
Brandenburg part	Very poor	Very poor	Fair
Cabba part	Very poor	Very poor	Fair
Cabba: CaE, [1] CbE (Badland part of CbE not rated.)	Very poor	Very poor	Fair
[1] CcD, [1] CdD:			
Cabba part	Poor	Fair	Fair
Chama part	Fair	Good	Fair
Cabbart:			
CfC, CfD	Poor	Poor	Fair
CfE, [1] CgE (Badland part of CgE not rated.)	Very poor	Very poor	Fair
Chama:			
CmA, CmB, [1] CoB, [1] CoC	Fair	Good	Fair
Cabba part of CoB and CoC	Fair	Good	Fair
[1] CoD:			
Chama part	Fair	Good	Fair
Cabba part	Poor	Fair	Fair
[1] CrC:			
Chama part	Fair	Good	Fair
Cabbart part	Poor	Fair	Fair
Chanta: CtA, CtB	Fair	Good	Good
Cherry: CyC	Fair	Good	Fair
Chinook: CzB	Fair	Good	Good
Daglum: DaB, DaC, [1] DhB	Fair	Good	Fair
Rhoades part of DhB	Poor	Poor	Poor
Dimmick: Dk	Fair	Fair	Poor
Ekalaka:			
[1] EdB, [1] EkB	Fair	Good	Poor
Desart part of EdB	Fair	Fair	Good
[1] EkC	Poor	Fair	Poor

habitat potentials

poor." Absence of an entry indicates that the soil was not rated]

Potential for habitat elements—Continued			Potential as habitat for—		
Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Very poor	Poor	Very poor	Poor	Very poor	Very poor.
Fair	Poor	Very poor	Good	Very poor	Fair.
Fair	Poor	Very poor	Good	Very poor	Fair.
Fair	Very poor	Very poor	Poor	Very poor	Fair.
Poor	Poor	Very poor	Fair	Very poor	Fair.
Very poor	Poor	Poor	Poor	Poor	Very poor.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Very poor	Poor	Very poor	Poor	Very poor	Very poor.
Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Poor	Very poor	Very poor	Poor	Very poor	Poor.
Fair					Fair.
Fair					Fair.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Fair	Very poor	Very poor	Poor	Very poor	Fair.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Fair					Fair.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Fair					Fair.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Poor	Poor	Very poor	Fair	Very poor	Fair.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Good	Very poor	Very poor	Good	Very poor	Good.
Very poor	Poor	Very poor	Fair	Very poor	Poor.
Very poor	Poor	Poor	Poor	Poor	Very poor.
Poor	Poor	Good	Fair	Fair	Poor.
Fair	Poor	Very poor	Fair	Very poor	Poor.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Fair	Poor	Very poor	Poor	Very poor	Poor.

TABLE 5.—*Wildlife*

Soil name and map symbol	Potential for habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Farland: FaA, FaB	Good	Good	Fair
Flasher:			
[1] FbE, [1] FhE	Very poor	Very poor	Fair
(Badland part of FbE not rated.)			
[1] FhD	Poor	Fair	Fair
Fleak:			
[1] FkE, [1] FlE	Very poor	Very poor	Fair
(Badland part of FkE not rated.)			
[1] FlD	Poor	Fair	Fair
Fluvaquentic Haplaquolls: Fu.			
Glendive:			
GlA, GlB.	Fair	Good	Good
Golva: GoC	Fair	Good	Fair
Grail: GrA, GrB, GtA, GtB	Good	Good	Fair
Grassna:			
GwA, [1] GxB	Good	Good	Fair
Golva part of GxB	Fair	Good	Fair
Hanly: [1] HaA	Poor	Fair	Fair
Harriet: [1] Hc	Poor	Poor	Fair
Havre: HeA	Fair	Good	Fair
Heil: [1] Hz:			
Heil part	Poor	Poor	Poor
McKenzie part	Poor	Poor	Poor
Korchea:			
KcA, [1] Kh	Good	Good	Fair
Havre part of Kh	Fair	Good	Fair
Kremlin: KrB, KrC	Fair	Good	Fair
Lawther:			
LaA, [1] Lc	Good	Good	Poor
LaB	Fair	Fair	Poor
Rhoades part of Lc	Poor	Poor	Poor
Lawther variant:			
LdA	Good	Good	Poor
LdC	Fair	Good	Poor
Lefor: [1] LeB, [1] LeC:			
Lefor part	Fair	Good	Good
Vebar part	Fair	Good	Good
Manning: MaA, MaB	Fair	Good	Good
Moreau:			
MeA, MeB	Fair	Good	Poor
MeC	Fair	Fair	Poor
Morton:			
MoA, MoB, [1] MpA, [1] MpB, [1] MrB	Good	Good	Fair
MoC, [1] MpC, [1] MrC	Fair	Good	Fair
Rhoades part of MrB and MrC	Poor	Poor	Poor
Mott: MsA, MsB, MtA, MtB	Fair	Good	Good
Parshall: PaB	Fair	Good	Good

habitat potentials—Continued

Potential for habitat elements—Continued			Potential as habitat for—		
Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Fair	Poor	Very poor	Good	Very poor	Fair.
Poor	Very poor	Very poor	Poor	Very poor	Poor.
Poor	Very poor	Very poor	Fair	Very poor	Poor.
Poor	Very poor	Very poor	Poor	Very poor	Poor.
Poor	Very poor	Very poor	Fair	Very poor	Poor.
Fair	Good	Poor	Fair	Poor	Fair.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Good	Poor	Very poor	Good	Very poor	Fair.
Good	Poor	Very poor	Good	Very poor	Fair.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Very poor	Good	Good	Poor	Good	Poor.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Very poor	Poor	Good	Poor	Fair	Very poor.
Poor	Poor	Good	Poor	Fair	Poor.
Good	Poor	Very poor	Good	Very poor	Fair.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Poor	Poor	Poor	Fair	Poor	Poor.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Very poor	Poor	Poor	Poor	Poor	Very poor.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Fair	Poor	Very poor	Good	Very poor	Fair.
Very poor	Poor	Very poor	Good	Very poor	Good.
Poor	Very poor	Very poor	Fair	Very poor	Fair.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Very poor	Poor	Poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Fair	Very poor	Fair.
Fair	Poor	Very poor	Good	Very poor	Fair.

TABLE 5.—*Wildlife*

Soil name and map symbol	Potential for habitat elements		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Patent:			
PeB, PeD, [1] PsD	Fair	Good	Fair
(Gullied land part of PsD not rated.)			
Sham part of PsD	Poor	Fair	Very poor
Reeder: ReA, ReB, ReC	Good	Good	Good
Regent:			
RgA, RgB, [1] RhA, [1] RhC	Good	Good	Good
Rhoades part of RhA and RhC	Poor	Poor	Poor
Rhame:			
[1] RkB, [1] RkC, [1] RmC, [1] RmD	Fair	Good	Good
Chinook part of RkB and RkC	Fair	Good	Good
Fleak part of RmC and RmD	Poor	Fair	Fair
Rhoades:			
[1] RsA, [1] RsC, [1] RxB	Poor	Poor	Poor
Belfield part of RsA and RsC	Fair	Good	Fair
Savage:			
SgA, SgB, [1] ShA	Fair	Good	Fair
Rhoades part of ShA	Poor	Poor	Poor
Searing:			
SlB, SmB	Fair	Fair	Good
Ringling part of SmB	Poor	Poor	Fair
Sen:			
SnA, SnB, SnC, [1] SoB, [1] SoC, [1] SrD	Fair	Good	Fair
Golva part of SoB and SoC	Fair	Good	Fair
Amor part of SrD	Good	Good	Good
Sham: [1] SsC	Poor	Fair	Very poor
Shambo: StA, StB	Good	Good	Good
Stady:			
SyA, SyB, [1] SzC	Fair	Fair	Good
Manning part of SzC	Fair	Good	Good
Tally: TaA, TaB	Fair	Good	Good
Telfer:			
[1] TeB	Fair	Good	Good
[1] TeC	Poor	Fair	Good
Vebar:			
[1] VfC, [1] VrB, [1] VrC	Fair	Good	Good
[1] VfD	Poor	Fair	Good
Flasher part of VfC and VfD	Poor	Fair	Fair
Tally part of VrB and VrC	Fair	Good	Good
Wabek: WaE	Poor	Poor	Poor
Wayden: WyC	Poor	Fair	Poor
Yetull: YeE	Poor	Poor	Good
Zeona: ZfC	Poor	Fair	Fair

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

habitat potentials—Continued

Potential for habitat elements—Continued			Potential as habitat for—		
Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Fair	Poor	Very poor	Fair	Very poor	Fair.
Poor	Poor	Very poor	Poor	Very poor	Very poor.
Fair	Poor	Very poor	Good	Very poor	Fair.
Poor	Poor	Very poor	Good	Very poor	Fair.
Very poor	Poor	Poor	Poor	Poor	Very poor.
Fair	Poor	Very poor	Good	Very poor	Fair.
Good	Very poor	Very poor	Good	Very poor	Good.
Poor	Very poor	Very poor	Fair	Very poor	Poor.
Very poor	Poor	Poor	Poor	Poor	Very poor.
Poor	Poor	Very poor	Fair	Very poor	Fair.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Very poor	Poor	Poor	Poor	Poor	Very poor.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Fair	Very poor	Very poor	Poor	Very poor	Fair.
Fair	Very poor	Very poor	Fair	Very poor	Fair.
Poor	Poor	Very poor	Fair	Very poor	Poor.
Fair	Poor	Very poor	Good	Very poor	Fair.
Poor	Poor	Very poor	Poor	Very poor	Very poor.
Fair	Poor	Very poor	Good	Very poor	Fair.
Fair	Poor	Very poor	Fair	Very poor	Fair.
Poor	Very poor	Very poor	Fair	Very poor	Fair.
Good	Very poor	Very poor	Good	Very poor	Good.
Fair	Very poor	Very poor	Good	Very poor	Fair.
Good			Fair	Very poor	Fair.
Very poor	Poor	Very poor	Good	Very poor	Good.
Very poor	Very poor	Very poor	Fair	Very poor	Good.
Poor	Very poor	Very poor	Fair	Very poor	Poor.
Good	Very poor	Very poor	Good	Very poor	Good.
Poor	Very poor	Very poor	Poor	Very poor	Poor.
Fair	Very poor	Very poor	Poor	Very poor	Poor.
Good	Very poor	Very poor	Fair	Very poor	Good.
	Very poor	Very poor	Fair	Very poor	Fair.

study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, millet, buckwheat, barley, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are bluegrass, bromegrass, clover, alfalfa, and trefoil.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, prairie sandreed, wheatgrass, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are wild rose, snowberry, and sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, and cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses, and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include antelope, white-tailed deer, mule deer, buffalo, sage grouse, meadowlark, and lark bunting.

Recreation

The soils of the survey area are rated in table 6 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 6 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption

TABLE 6.—*Recreational development*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Degree and kind of limitation for—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Absher: AbA, AbC	Severe: too clayey, percs slowly, dusty.	Severe: too clayey, dusty.	Severe: too clayey, dusty.	Severe: too clayey, dusty.
Amor:				
AgA, AgB	Slight	Slight	Moderate: slope	Slight.
AgC	Slight	Slight	Severe: slope	Slight.
Arnegard: ArB	Slight	Slight	Moderate: slope	Slight.
Badland:				
[1] BaF (Cabbart part) (Badland part not rated.)	Severe: slope	Severe: slope	Severe: slope, percs slowly.	Severe: slope.
Bb.				
Belfield:				
BeA, BeB	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
BfA, BfB, [1] BhA, [1] BhB	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly, slope, too clayey.	Moderate: too clayey.
Rhoades part of BhA and BhB	Severe: percs slowly	Moderate: too clayey.	Severe: percs slowly	Moderate: too clayey.
Benz:				
BkC	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
[1] BnC:				
Benz part	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: percs slowly, too clayey, slope.	Moderate: too clayey.
Absher part	Severe: too clayey, percs slowly, dusty.	Severe: too clayey, dusty.	Severe: too clayey, dusty.	Severe: too clayey, dusty.
Borolls:				
Bo.				
[1] BrE	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones.
Boxwell:				
BtB	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
BtC	Moderate: dusty	Moderate: dusty	Severe: slope	Moderate: dusty.
Brandenburg: [1] BuE:				
Brandenburg part	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Cabba part	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Moderate: slope.
Cabba:				
CaE	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Severe: slope.
[1] CbE (Badland part not rated.)	Severe: slope	Severe: slope	Severe: slope, depth to rock.	Moderate: slope.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Degree and kind of limitation for—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
[1] CcD: Cabba part	Moderate: slope	Moderate: slope	Severe: slope, depth to rock.	Slight.
Chama part	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
[1] CdD	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Cabbart: CfC	Moderate: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.
CfD	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope, percs slowly.	Slight.
CfE	Severe: slope	Severe: slope	Severe: slope, percs slowly.	Severe: slope.
[1] CgE (Badland part not rated.)	Severe: slope	Severe: slope	Severe: slope, percs slowly.	Moderate: slope.
Chama: CmA	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
CmB, [1] CoB	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Cabba part of CoB	Slight	Slight	Severe: depth to rock.	Slight.
[1] CoC, [1] CrC	Moderate: percs slowly.	Slight	Severe: slope	Slight.
Cabba part of CoC	Slight	Slight	Severe: slope, depth to rock.	Slight.
Cabbart part of CrC	Moderate: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.
[1] CoD: Chama part	Moderate: slope, percs slowly.	Moderate: slope	Severe: slope	Slight.
Cabba part	Moderate: slope	Moderate: slope	Severe: slope, depth to rock.	Slight.
Chanta: CtA, CtB	Slight	Slight	Moderate: slope	Slight.
Cherry: CyC	Moderate: percs slowly.	Moderate: too clayey.	Severe: slope	Moderate: too clayey.
Chinook: CzB	Slight	Slight	Moderate: slope	Slight.
Daglum: DaB, DaC	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
[1] DhB	Severe: percs slowly	Moderate: too clayey.	Severe: percs slowly	Moderate: too clayey.
Dimmick: Dk	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.	Severe: wetness, too clayey.
Ekalaka: [1] EdB, [1] EkB	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
[1] EkC	Moderate: percs slowly.	Moderate: slope	Severe: slope	Slight.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Degree and kind of limitation for—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Farland: FaA, FaB	Slight	Slight	Moderate: slope	Slight.
Flasher: [1] FbE (Badland part not rated.)	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
[1] FhD	Moderate: slope	Moderate: slope	Severe: slope	Slight.
[1] FhE	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Fleak: [1] FkE (Badland part not rated.)	Severe: slope	Severe: slope	Severe: depth to rock.	Moderate: slope.
[1] FlD	Moderate: slope	Moderate: slope	Severe: depth to rock.	Slight.
[1] FlE	Severe: slope	Severe: slope	Severe: depth to rock.	Severe: slope.
Fluvaquentic Haplaquolls: Fu	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness.
Glendive: GlA, GlB	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
Golva: GoC	Slight	Slight	Severe: slope	Slight.
Grail: GrA, GrB	Slight	Slight	Moderate: slope	Slight.
GtA, GtB	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope	Moderate: too clayey.
Grassna: GwA, [1] GxB	Slight	Slight	Moderate: slope	Slight.
Hanly: [1] HaA	Moderate: too sandy, floods.	Moderate: too sandy.	Moderate: too sandy, floods.	Moderate: too sandy.
Harriet: [1] Hc	Severe: wetness, floods.	Severe: wetness	Severe: wetness, floods.	Severe: wetness.
Havre: HeA	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Heil: [1] Hz: Heil part	Severe: wetness, floods, percs slowly.	Severe: wetness	Severe: wetness, floods, percs slowly.	Severe: wetness.
McKenzie part	Severe: floods, percs slowly.	Severe: too clayey	Severe: floods, percs slowly.	Severe: too clayey.
Korchea: KcA, [1] Kh	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Kremlin: KrB	Moderate: dusty	Moderate: dusty	Moderate: slope, dusty.	Moderate: dusty.
KrC	Moderate: dusty	Moderate: dusty	Severe: slope	Moderate: dusty.
Lawther: LaA, LaB, [1] Lc	Severe: too clayey, percs slowly, dusty.	Severe: too clayey, dusty.	Severe: too clayey, percs slowly, dusty.	Severe: too clayey, dusty.
Rhoades part of Lc	Severe: percs slowly	Severe: too clayey	Severe: percs slowly	Severe: too clayey.
Lawther variant: LdA, LdC	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Degree and kind of limitation for—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lefor: [1] LeB:				
Lefor part	Slight	Slight	Moderate: slope	Slight.
Vebar part	Slight	Slight	Moderate: depth to rock.	Slight.
[1] LeC	Slight	Slight	Severe: slope	Slight.
Manning: MaA, MaB	Slight	Slight	Moderate: slope	Slight.
Moreau: MeA, MeB, MeC	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Morton: MoA, MoB, [1] MpA, [1] MpB, [1] MrB	Slight	Slight	Moderate: depth to rock.	Slight.
MoC, [1] MpC, [1] MrC	Slight	Slight	Severe: slope	Slight.
Rhoades part of MrB and MrC	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
Mott: MsA, MsB, MtA, MtB	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Parshall: PaB	Slight	Slight	Moderate: slope	Slight.
Patent: PeB	Slight	Slight	Moderate: slope	Slight.
PeD, [1] PsD (Gullied land part of PsD not rated.)	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Sham part of PsD	Moderate: percs slowly, slope.	Moderate: slope	Severe: slope	Slight.
Reeder: ReA, ReB	Slight	Slight	Moderate: slope	Slight.
ReC	Slight	Slight	Severe: slope	Slight.
Regent: RgA, RgB, [1] RhA	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
[1] RhC	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: slope	Moderate: too clayey.
Rhoades part of RhA and RhC	Severe: percs slowly	Moderate: too clayey.	Severe: percs slowly	Moderate: too clayey.
Rhame: [1] RkB	Slight	Slight	Moderate: slope	Slight.
[1] RkC, [1] RmC	Slight	Slight	Severe: slope	Slight.
Fleak part of RmC	Slight	Slight	Severe: depth to rock.	Slight.
[1] RmD:				
Rhame part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Fleak part	Moderate: slope	Moderate: slope	Severe: depth to rock.	Slight.
Rhoades: [1] RsA, [1] RsC, [1] RxB	Severe: percs slowly	Slight	Severe: percs slowly	Slight.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Degree and kind of limitation for—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Belfield part of RsA	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
Belfield part of RsC	Moderate: percs slowly.	Slight	Severe: slope	Slight.
Savage: SgA, SgB, [1] ShA	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: slope, percs slowly, too clayey.	Moderate: too clayey.
Rhoades part of ShA	Severe: percs slowly	Moderate: too clayey.	Severe: percs slowly	Moderate: too clayey.
Searing: SlB	Slight	Slight	Moderate: slope	Slight.
[1] SmB	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
Sen: SnA, SnB, [1] SoB	Slight	Slight	Moderate: slope	Slight.
SnC, [1] SoC	Slight	Slight	Severe: slope	Slight.
[1] SrD: Sen part	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Amor part	Severe: slope	Moderate: slope	Severe: slope	Slight.
Sham: [1] SsC	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Shambo: StA, StB	Slight	Slight	Moderate: slope	Slight.
Stady: SyA, SyB	Slight	Slight	Moderate: slope	Slight.
[1] SzC	Slight	Slight	Severe: slope	Slight.
Tally: TaA, TaB	Slight	Slight	Moderate: slope	Slight.
Telfer: [1] TeB Telfer part	Moderate: too sandy	Moderate: too sandy.	Moderate: too sandy	Moderate: too sandy.
Lihen part	Moderate: too sandy	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
[1] TeC	Moderate: too sandy	Moderate: too sandy.	Severe: slope	Moderate: too sandy.
Vebar: [1] VfC, [1] VrC	Slight	Slight	Severe: slope	Slight.
[1] VfD	Moderate: slope	Moderate: slope	Severe: slope	Slight.
[1] VrB: Vebar part	Slight	Slight	Moderate: depth to rock.	Slight.
Tally part	Slight	Slight	Moderate: slope	Slight.
Wabek: WaE	Moderate: slope	Moderate: slope	Severe: slope	Slight.

TABLE 6.—*Recreational development*—Continued

Soil name and map symbol	Degree and kind of limitation for—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Wayden: WyC	Severe: too clayey	Severe: too clayey	Severe: depth to rock, percs slowly.	Severe: too clayey.
Yetull: YeE	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: too sandy.
Zeona: ZfC	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7. (See the section "Engineering.")

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Engineering [5]

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6)

[5] A. RICHARD MOUM, state conservation engineer, Soil Conservation Service, helped prepare this section.

TABLE 7.—*Building site development*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Degree and kind of limitation for—				
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Absher: AbA, AbC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Amor: AgA, AgB, AgC	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
Arnegard: ArB	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: frost action.
Badland: [1] BaF (Cabbart part) (Badland part not rated.)	Severe: slope	Severe: slope	Severe: depth to rock, slope.	Severe: slope	Severe: slope.
Bb.					
Belfield: BeA, BeB, BfA, BfB, [1] BhA, [1] BhB.	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Rhoades part of BhA and BhB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Benz: BkC, [1] BnC	Moderate: floods, too clayey.	Severe: floods	Severe: floods	Severe: floods	Moderate: frost action, low strength, shrink-swell.
Absher part of BnC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Borolls: Bo	Severe: wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.
[1] BrE: Borolls part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Orthents part	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Boxwell: BtB, BtC	Moderate: depth to rock.	Moderate: low strength, frost action.	Moderate: depth to rock, shrink-swell, low strength.	Moderate: slope, low strength, frost action.	Moderate: frost action, shrink-swell, low strength.
Brandenburg: [1] BuE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Cabba: CaE, [1] CbE (Badland part of CbE not rated.)	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] CcD	Moderate: depth to rock, slope.	Moderate: slope, frost action, depth to rock.	Moderate: slope, depth to rock.	Severe: slope	Moderate: slope, frost action, depth to rock.
[1] CdD	Moderate: small stones, depth to rock, slope.	Moderate: slope, frost action, depth to rock.	Moderate: slope, depth to rock.	Severe: slope	Moderate: slope, frost action, depth to rock.

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Chama part of CcD and CdD	Moderate: slope.	Moderate: slope, frost action, low strength.	Moderate: slope, frost action, low strength.	Severe: slope	Moderate: frost action, slope.
Cabbart: CfC	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action. depth to rock.
CfD	Severe: slope, depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: depth to rock.	Severe: slope	Moderate: slope, depth to rock, frost action.
CfE, [1] CgE (Badland part of CgE not rated.)	Severe: slope	Severe: slope	Severe: depth to rock, slope.	Severe: slope	Severe: slope.
Chama: CmA.					
CmB, [1] CoB, [1] CoC, [1] CrC	Slight	Moderate: frost action, low strength.	Moderate: frost action, low strength.	Moderate: slope, frost action, low strength.	Moderate: frost action, low strength.
Cabba part of CoB and CoC	Moderate: depth to rock.	Moderate: frost action, depth to rock.	Moderate: depth to rock.	Moderate: slope, depth to rock, frost action.	Moderate: frost action, depth to rock.
Cabbart part of CrC	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Severe: slope	Moderate: frost action.
[1] CoD: Chama part	Moderate: slope.	Moderate: slope, frost action, low strength.	Moderate: slope, frost action, low strength.	Severe: slope	Moderate: frost action, slope.
Cabba part	Moderate: depth to rock, slope.	Moderate: slope, frost action, depth to rock.	Moderate: slope, depth to rock.	Severe: slope	Moderate: slope frost action, depth to rock.
Chanta: CtA	Severe: cut-banks cave.	Slight	Slight	Slight	Moderate: frost action.
CtB	Severe: cut-banks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
Cherry: CyC	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
Chinook: CzB	Severe: cut-banks cave.	Moderate: frost action.	Moderate: frost action.	Moderate: frost action.	Moderate: frost action, low strength.
Daglum: DaB, DaC, [1] DhB	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Rhoades part of DhB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Dimmick: Dk	Severe: floods, wetness, too clayey.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ekalaka:					
[1] EdB, [1] EkB	Slight	Slight	Slight	Slight	Moderate: frost action.
[1] EkC	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Farland: FaA, FaB	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
Flasher:					
[1] FbE, [1] FhE (Badland part of FbE not rated.)	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] FhD	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope	Moderate: depth to rock.
Fleak:					
[1] FkE, [1] FlE (Badland part of FkE not rated.)	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
[1] FlD	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope	Moderate: depth to rock.
Fluvaquentic Haplaquolls: Fu	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Glendive: GlA, GlB	Moderate: floods.	Severe: floods	Severe: floods	Severe: floods	Moderate: frost action, floods, low strength.
Golva: GoC	Slight	Moderate: shrink-swell, low strength, frost action.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, frost action, low strength.
Grail: GrA, GrB, GtA, GtB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Grassna:					
GwA, [1] GxB	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.
Golva part of GxB	Slight	Moderate: shrink-swell, low strength, frost action.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, frost action, low strength.
Hanly: [1] HaA	Severe: cutbanks cave, floods.	Severe: floods	Severe: floods	Severe: floods	Moderate: floods.
Harriet: [1] Hc	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, low strength.
Havre: HeA	Moderate: floods.	Severe: floods	Severe: floods	Severe: floods	Moderate: frost action, low strength.

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Heil: [1] Hz:					
Heil part	Severe: too clayey, wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness floods, shrink-swell.
McKenzie part	Severe: floods	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.
Korchea:					
KcA, [1] Kh	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Havre part of Kh	Moderate: floods.	Severe: floods	Severe: floods	Severe: floods	Moderate: frost action, low strength.
Kremlin:					
KrB	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: frost action, low strength.
KrC	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: frost action, low strength.
Lawther:					
LaA, LaB, [1] Lc	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Rhoades part of Lc	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Lawther variant: LdA, LdC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Lefor:					
[1] LeB, [1] LeC	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
Vebar part of LeB	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Slight.
Vebar part of LeC	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
Manning:					
MaA	Severe: cut-banks cave.	Slight	Slight	Slight	Slight.
MaB	Severe: cut-banks cave.	Slight	Slight	Moderate: slope.	Slight.
Moreau: MeA, MeB, MeC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Morton:					
MoA, MoB, MoC, [1] MpA, [1] MpB, [1] MpC, [1] MrB, [1] MrC	Moderate. depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
Rhoades part of MrB and MrC	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Mott: MsA, MsB, MtA, MtB	Moderate: floods, wetness.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Parshall: PaB	Slight	Moderate: frost action.	Slight	Moderate: frost action.	Moderate: frost action.
Patent: PeB	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
PeD, [1] PsD (Gullied land part of PsD not rated.)	Moderate: slope.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: slope	Moderate: shrink-swell, frost action.
Sham part of PsD	Moderate: slope.	Moderate: shrink-swell, frost action.	Moderate: shrink-swell, frost action.	Severe: slope	Moderate: frost action, shrink-swell.
Reeder: ReA, ReB, ReC	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.
Regent: RgA, RgB, [1] RhA	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
[1] RhC and Rhoades part of RhA	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Rhame: [1] RkB, [1] RkC, [1] RmC	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Moderate: slope, frost action.	Moderate: frost action.
Chinook part of RkB and RkC	Severe: cut-banks cave.	Moderate: frost action.	Moderate: frost action.	Moderate: slope, frost action.	Moderate: frost action, low strength.
Fleak part of RmC	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
[1] RmD: Rhame part	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Severe: slope	Moderate: frost action.
Fleak part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope	Moderate: depth to rock.
Rhoades: [1] RsA, [1] RsC, [1] RxB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Belfield part of RsA and RsC	Moderate: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Savage: SgA, SgB, [1] ShA	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Rhoades part of ShA	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Searing: SlB, [1] SmB	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action, shrink-swell, low strength.
Ringling part of SmB	Severe: cutbanks cave.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope	Moderate: depth to rock.
Sen: SnA, SnB, SnC, [1] SoB, [1] SoC	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action, low strength.
Golva part of SoB and SoC	Slight	Moderate: shrink-swell, low strength, frost action.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, frost action, low strength.
[1] SrD: Sen part	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: slope	Moderate: shrink-swell, frost action, low strength.
Amor part	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Severe: slope	Moderate: shrink-swell, frost action.
Sham: [1] SsC	Slight	Moderate: shrink-swell, frost action.	Moderate: shrink-swell, frost action.	Moderate: shrink-swell, frost action.	Moderate: frost action, shrink-swell.
Shambo: StA StB	Slight	Moderate: shrink-swell, frost action.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: frost action, shrink-swell, low strength.
Stady: SyA	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action, low strength.
SyB, [1] SzC	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action, low strength.
Manning part of SzC	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Tally: TaA	Severe: cutbanks cave.	Moderate: frost action.	Moderate: frost action.	Moderate: frost action.	Moderate: low strength, frost action.
TaB	Severe: cutbanks cave.	Moderate: frost action.	Moderate: frost action.	Moderate: slope, frost action.	Moderate: low strength, frost action.
Telfer: [1] TeB: Telfer part	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Lihen part	Severe: too sandy, cutbanks cave.	Moderate: frost action.	Slight	Moderate: frost action.	Moderate: frost action.

TABLE 7.—*Building site development*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
[1] TeC:					
Telfer part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Lihen part	Severe: too sandy, cutbanks cave.	Moderate: frost action.	Slight	Severe: slope	Moderate: frost action.
Vebar:					
[1] VfC, [1] VrB, [1] VrC	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Slight.
Flasher part of VfC	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Tally part of VrB	Severe: cutbanks cave.	Moderate: frost action.	Moderate: frost action.	Moderate: slope, frost action.	Moderate: low strength, frost action.
Tally part of VrC	Severe: cutbanks cave.	Moderate: frost action.	Moderate: frost action.	Severe: slope	Moderate: low strength, frost action.
[1] VfD:					
Vebar part	Moderate: depth to rock.	Moderate: slope.	Moderate: depth to rock.	Severe: slope	Moderate: slope.
Flasher part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope	Moderate: depth to rock.
Wabek: WaE	Moderate: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope	Moderate: slope.
Wayden: WyC	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Yetull: YeE	Severe: cutbanks cave, slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Zeona: ZfC	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

find sources of gravel, sand, clay, and topsoils; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slopes, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, and *poor*, which, mean about the same as *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil mate-

TABLE 8.—*Sanitary facilities*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils]

Soil name and map symbol	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Absher: AbA, AbC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, area reclaim.
Amor: AgA, AgB, AgC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: area reclaim, thin layer.
Arnegard: ArB	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Badland: BaF (Cabbart part). (Bb and Badland part of BaF not rated.)	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope	Poor: slope, thin layer, area reclaim.
Belfield: BeA, BeB, BfA, BfB, [1] BhA, [1] BhB.	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Rhoades part of BhA and BhB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Benz: BkC	Severe: percs slowly.	Moderate: slope.	Moderate: floods.	Moderate: floods.	Fair: too clayey.
[1] BnC: Benz part	Severe: percs slowly.	Moderate: slope.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Absher part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, area reclaim.
Borolls: Bo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
[1] BrE: Borolls part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope	Poor: slope, large stones.
Orthents part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: slope	Poor: slope.
Boxwell: BtB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer, area reclaim.
BtC	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer, area reclaim.
Brandenburg: [1] BuE: Brandenburg part	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: thin layer, area reclaim.
Cabba part	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.

TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Cabba:					
CaE	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope	Poor: slope, thin layer, area reclaim.
[1] CbE (Badland part not rated.)	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope	Poor: slope, thin layer, area reclaim.
[1] CcD, [1] CdD:					
Cabba part	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Chama part	Severe: percs slowly, depth to rock.	Severe: slope	Moderate: depth to rock.	Moderate: slope.	Fair: slope.
Cabbart:					
CfC	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
CfD	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
CfE, [1] CgE (Badland part of CgE not rated.)	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope	Poor: slope, thin layer, area reclaim.
Chama:					
CmA	Severe: percs slowly, depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Slight	Good.
CmB, [1] CoB	Severe: percs slowly, depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Slight	Good.
Cabba part of CoB	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
[1] CoC, [1] CrC:					
Chama part	Severe: percs slowly, depth to rock.	Severe: slope	Moderate: depth to rock.	Slight	Good.
Cabba part of CoC and Cabbart part of CrC.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
[1] CoD:					
Chama part	Severe: percs slowly, depth to rock.	Severe: slope	Moderate: depth to rock.	Moderate: slope.	Fair: slope.
Cabba part	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, area reclaim.
Chanta: CtA, CtB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer, area reclaim.
Cherry: CyC	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Chinook: CzB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Daglum:					
DaB, [1] DhB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, thin layer.

TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Rhoades part of DhB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
DaC	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Slight	Poor: too clayey, thin layer.
Dimmick: Dk	Severe: floods, wetness, percs slowly.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
Ekalaka: [1] EdB, [1] EkB, [1] EkC	Slight	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim.
Desart part of EdB	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: area reclaim.
Farland: FaA, FaB	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Flasher: [1] FbE, [1] FhD, [1] FhE (Badland part of FbE not rated.)	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: thin layer.
Fleak: [1] FkE, [1] FlD, [1] FlE (Badland part of FkE not rated.)	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: thin layer, area reclaim.
Fluvaquentic Haplaquolls: Fu	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Glendive: GlA, GlB	Moderate: floods.	Severe: seepage, floods.	Severe: seepage.	Severe: seepage.	Good.
Golva: GoC	Moderate: percs slowly.	Severe: slope	Slight	Slight	Good.
Grail: GrA, GrB, GtA, GtB	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Grassna: GwA, [1] GxB	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Hanly: [1] HaA	Severe: floods	Severe: seepage.	Severe: seepage, floods.	Severe: seepage, floods.	Fair: too sandy.
Harriet: [1] Hc	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Havre: HeA	Moderate: percs slowly, floods.	Severe: floods	Moderate: floods.	Moderate: floods.	Good.
Heil: [1] Hz: Heil part	Severe: percs slowly, wetness, floods.	Slight	Severe: too clayey, wetness.	Severe: floods	Poor: too clayey, wetness.
McKenzie part	Severe: percs slowly.	Slight	Severe: floods	Severe: floods	Poor: too clayey.
Korchea: KcA, [1] Kh	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Good.
Havre part of Kh	Moderate: percs slowly, floods.	Severe: floods	Moderate: floods.	Moderate: floods.	Good.

TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Kremlin: KrB, KrC	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Lawther: LaA, LaB, [1] Lc	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Lawther variant: LdA, LdC	Slight	Severe: seepage.	Severe: seepage.	Slight	Poor: too clayey.
Lefor: [1] LeB, [1] LeC:					
Lefor part	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
Vebar part	Severe: depth to rock.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Manning: MaA, MaB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Moreau:					
MeA, MeB	Severe: percs slowly, depth to rock.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
MeC	Severe: percs slowly, depth to rock.	Severe: slope	Severe: too clayey.	Slight	Poor: too clayey.
Morton:					
MoA, MoB MoC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer.
[1] MpA, [1] MpB, [1] MpC, [1] MrB, [1] MrC.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey, thin layer.
Rhoades part of MrB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Rhoades part of MrC	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Slight	Poor: too clayey.
Mott: MsA, MsB, MtA, MtB	Severe: floods	Severe: seepage, floods.	Severe: seepage, floods.	Severe: seepage, floods.	Good.
Parshall: PaB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Patent:					
PeB	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
PeD, [1] PsD	Moderate: percs slowly.	Severe: slope	Slight	Moderate: slope.	Fair: slope.
Sham part of PsD (Gullied land part of PsD not rated.)	Severe: percs slowly.	Severe: slope	Slight	Moderate: slope.	Fair: slope.
Reeder: ReA, ReB, ReC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer, area reclaim.
Regent:					
RgA, RgB, [1] RhA	Severe: percs slowly, depth to rock.	Moderate: depth to rock.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
Rhoades part of RhA	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
[1] RhC:					
Regent part	Severe: percs slowly, depth to rock.	Severe: slope	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
Rhoades part	Severe: percs slowly.	Severe: slope	Severe: too clayey.	Slight	Poor: too clayey.
Rhame: [1] RkB, [1] RkC, [1] RmC, [1] RmD	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Chinook part of RkB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Chinook part of RkC	Slight	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Good.
Fleak part of RmC and RmD	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: thin layer, area reclaim.
Rhoades: [1] RsA, [1] RsC, [1] RxB	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Belfield part of RsA and RsC	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Savage: SgA, SgB, [1] ShA	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Fair: too clayey.
Rhoades part of ShA	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Searing: SlB	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: thin layer, area reclaim.
[1] SmB	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer, area reclaim, small stones.
Ringling part of SmB	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer, small stones.
Sen: SnA, SnB, SnC, [1] SoB, [1] SoC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: thin layer, area reclaim.
Golva part of SoB	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Golva part of SoC	Moderate: percs slowly.	Severe: slope	Slight	Slight	Good.
[1] SrD	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer, area reclaim.
Sham: [1] SsC	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.

TABLE 8.—*Sanitary facilities*—Continued

Soil name and map symbol	Degree and kind of limitation for—				
	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Shambo: StA, StB	Slight	Moderate: seepage.	Slight	Slight	Good.
Stady: SyA, SyB, [1] SzC	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: thin layer.
Manning part of SzC	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Tally: TaA, TaB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Telfer: [1] TeB, [1] TeC	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: too sandy.
Lihen part of TeB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy, seepage.
Lihen part of TeC	Slight	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy, seepage.
Vebar: [1] VfC, [1] VfD, [1] VrB, [1] VrC	Severe: depth to rock.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Flasher part of VfC and VfD	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: thin layer.
Tally part of VrB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Tally part of VrC	Slight	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Wabek: WaE	Moderate: slope.	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Poor: thin layer.
Wayden: WyC	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Slight	Poor: thin layer, area reclaim, too clayey.
Yetull: YeE	Severe: slope	Severe: slope, seepage.	Severe: slope, seepage, too sandy.	Severe: slope, seepage.	Poor: slope, seepage, area reclaim.
Zeona: ZfC	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

rial. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. Where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to

heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the section "Descriptions of the Soils."

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 11 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low frost action potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 11.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitability layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on

TABLE 9.—*Construction materials*

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor."]

Soil name and map symbol	Suitability for—			
	Roadfill	Sand	Gravel	Topsoil
Absher: AbA, AbC	Poor: shrink-swell, low strength, area reclaim.	Unsuited	Unsuited	Poor: area reclaim, too clayey, excess salt.
Amor: AgA, AgB, AgC	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Good.
Arnegard: ArB	Fair: frost action	Unsuited	Unsuited	Good.
Badland: [1] BaF (Cabbart part). (Bb and Badland part of BaF not rated.)	Poor: thin layer, slope.	Unsuited	Unsuited	Poor: slope, thin layer, area reclaim.
Belfield:				
BeA, BeB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: thin layer.
BfA, BfB, [1] BhA, [1] BhB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: thin layer, too clayey.
Rhoades part of BhA and BhB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess alkali, area reclaim.
Benz:				
BkC, [1] BnC	Fair: low strength, shrink-swell.	Unsuited	Unsuited	Poor: excess alkali, excess salt.
Absher part of BnC	Poor: shrink-swell, low strength, area reclaim.	Unsuited	Unsuited	Poor: area reclaim, too clayey, excess salt.
Borolls:				
Bo	Poor: wetness, low strength.	Unsuited	Unsuited	Poor: excess salt.
[1] BrE:				
Borolls part	Poor: large stones	Unsuited	Unsuited	Poor: large stones.
Orthents part	Poor: thin layer, large stones.	Unsuited	Unsuited	Poor: slope, large stones.
Boxwell: BtB, BtC	Fair: low strength, frost action, thin layer.	Unsuited	Unsuited	Fair: too clayey.
Brandenburg: [1] BuE:				
Brandenburg part	Fair: slope	Unsuited	Unsuited	Poor: area reclaim.
Cabba part	Fair: slope, frost action.	Unsuited	Unsuited	Poor: slope.
Cabba:				
CaE	Poor: slope	Unsuited	Unsuited	Poor: slope.
[1] CbE (Badland part not rated.)	Fair: slope, frost action.	Unsuited	Unsuited	Poor: slope.
[1] CcD:				
Cabba part	Fair: frost action	Unsuited	Unsuited	Fair: thin layer, slope.
Chama part	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: slope.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Suitability for—			
	Roadfill	Sand	Gravel	Topsoil
[1] CdD:				
Cabba part	Fair: frost action	Unsuited	Unsuited	Fair: slope, small stones.
Chama part	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: slope, small stones.
Cabbart:				
CfC	Fair: frost action	Unsuited	Unsuited	Poor: thin layer, area reclaim.
CfD	Poor: thin layer	Unsuited	Unsuited	Poor: thin layer, area reclaim.
CfE, [1] CgE (Badland part of CgE not rated.)	Poor: thin layer, slope.	Unsuited	Unsuited	Poor: slope, thin layer, area reclaim.
Chama:				
CmA, CmB, [1] CoB, [1] CoC, [1] CrC.	Fair: frost action, low strength.	Unsuited	Unsuited	Good.
Cabba part of CoB and CoC, and Cabbart part of CrC.	Fair: frost action	Unsuited	Unsuited	Fair: thin layer.
[1] CoD:				
Chama part	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: slope.
Cabba part	Fair: frost action	Unsuited	Unsuited	Fair: thin layer, slope.
Chanta: CtA, CtB	Fair: frost action	Poor: excess fines	Poor: excess fines	Good.
Cherry: CyC	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Fair: too clayey.
Chinook: CzB	Fair: frost action, low strength.	Poor: excess fines	Unsuited	Good.
Daglum:				
DaB, DaC, [1] DhB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, area reclaim.
Rhoades part of DhB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess alkali, area reclaim.
Dimmick: Dk	Poor: wetness, shrink-swell.	Unsuited	Unsuited	Poor: wetness, too clayey.
Ekalaka:				
[1] EdB, [1] EkB, [1] EkC	Fair: frost action	Poor: excess fines	Unsuited	Fair: area reclaim, excess alkali, thin layer.
Desart part of EdB	Fair: frost action	Poor: excess fines	Unsuited	Good.
Farland: FaA, FaB	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Fair: too clayey.
Flasher:				
[1] FbE (Badland part not rated.)	Fair: slope	Unsuited	Unsuited	Poor: thin layer.
[1] FhD	Good	Unsuited	Unsuited	Poor: thin layer.
[1] FhE	Poor: slope	Unsuited	Unsuited	Poor: thin layer.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Suitability for—			
	Roadfill	Sand	Gravel	Topsoil
Fleak: [1] FkE (Badland part not rated.)	Fair: slope	Poor: excess fines	Unsuited	Poor: thin layer, area reclaim.
[1] FlD	Good	Poor: excess fines	Unsuited	Poor: thin layer, area reclaim.
[1] FlE	Poor: slope	Poor: excess fines	Unsuited	Poor: thin layer, area reclaim.
Fluvaquentic Haplaquolls: Fu	Poor: wetness	Unsuited	Unsuited	Poor: wetness.
Glendive: GlA, GlB	Fair: frost action, low strength.	Poor: excess fines	Unsuited	Fair: excess salt.
Golva: GoC	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Good.
Grail: GrA, GrB	Fair: frost action	Unsuited	Unsuited	Good.
GtA, GtB	Fair: frost action	Unsuited	Unsuited	Fair: too clayey.
Grassna: GwA, [1] GxB	Fair: shrink-swell	Unsuited	Unsuited	Good.
Golva part of GxB	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Good.
Hanly: [1] HaA	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Harriet: [1] Hc	Poor: wetness, low strength.	Unsuited	Unsuited	Poor: wetness, excess salt, excess alkali.
Havre: HeA	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
Heil: [1] Hz Heil part	Poor: wetness, shrink-swell.	Unsuited	Unsuited	Poor: wetness, too clayey.
McKenzie part	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Korchea: KcA, [1] Kh	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Good.
Havre part of Kh	Fair: frost action, low strength.	Unsuited	Unsuited	Fair: thin layer.
Kremlin: KrB, KrC	Fair: frost action, low strength.	Unsuited	Unsuited	Good.
Lawther: LaA, LaB, [1] Lc	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Rhoades part of Lc	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess alkali, area reclaim.
Lawther variant: LdA, LdC	Poor: shrink-swell, low strength.	Fair: excess fines	Unsuited	Poor: too clayey.
Lefor: [1] LeB, [1] LeC	Fair: shrink-swell, frost action.	Poor: excess fines	Unsuited	Fair: thin layer.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Suitability for—			
	Roadfill	Sand	Gravel	Topsoil
Vebar part of LeB and LeC	Good	Poor: excess fines	Unsuited	Good.
Manning: MaA, MaB	Good	Poor: excess fines	Poor: excess fines	Poor: area reclaim.
Moreau: MeA, MeB, MeC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Morton: MoA, MoB, MoC, [1] MpA, [1] MpB, [1] MpC, [1] MrB, [1] MrC	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Fair: too clayey.
Rhoades part of MrB and MrC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess alkali, area reclaim.
Mott: MsA, MsB, MtA, MtB	Good	Poor: excess fines	Unsuited	Good.
Parshall: PaB	Fair: frost action	Poor: excess fines	Unsuited	Good.
Patent: PeB, PeD, [1] PsD	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Poor: thin layer.
Sham part of PsD (Gullied land part of PsD not rated.)	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Poor: excess alkali.
Reeder: ReA, ReB, ReC	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Good.
Regent: RgA, RgB, [1] RhA, [1] RhC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey, thin layer.
Rhoades part of RhA	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess alkali, area reclaim.
Rhoades part of RhC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey, thin layer.
Rhame: [1] RkB, [1] RkC, [1] RmC	Fair: frost action	Poor: excess fines	Unsuited	Good.
Chinook part of RkB and RkC	Fair: frost action, low strength.	Poor: excess fines	Unsuited	Good.
Fleak part of RmC	Good	Poor: excess fines	Unsuited	Poor: thin layer, area reclaim.
[1] RmD: Rhame part	Fair: frost action	Poor: excess fines	Unsuited	Fair: slope.
Fleak part	Good	Poor: excess fines	Unsuited	Poor: thin layer, area reclaim.
Rhoades: [1] RsA, [1] RsC, [1] RxB	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess alkali, area reclaim.
Belfield part of RsA and RsC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: thin layer.

TABLE 9.—*Construction materials*—Continued

Soil name and map symbol	Suitability for—			
	Roadfill	Sand	Gravel	Topsoil
Savage: SgA, SgB, [1] ShA	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Fair: too clayey.
Rhoades part of ShA	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: thin layer, excess alkali, area reclaim.
Searing: SlB, [1] SmB	Fair: frost action, shrink-swell, low strength.	Unsuited	Unsuited	Good.
Ringling part of SmB	Good	Unsuited	Unsuited	Poor: thin layer, small stones.
Sen: SnA, SnB, SnC, [1] SoB, [1] SoC.	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Good.
[1] SrD	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Fair: slope.
Amor part	Fair: shrink-swell, frost action.	Unsuited	Unsuited	Fair: slope.
Sham: [1] SsC	Fair: frost action, shrink-swell.	Unsuited	Unsuited	Poor: excess alkali.
Shambo: StA, StB	Fair: shrink-swell, frost action, low strength.	Unsuited	Unsuited	Good.
Stady: SyA, SyB, [1] SzC	Good	Fair: excess fines	Fair: excess fines	Good.
Manning part of SzC	Good	Poor: excess fines	Poor: excess fines	Poor: area reclaim.
Tally: TaA, TaB	Fair: frost action	Poor: excess fines	Unsuited	Good.
Telfer: [1] TeB, [1] TeC	Good	Poor: excess fines	Unsuited	Poor: too sandy.
Lihen part	Fair: frost action	Poor: excess fines	Unsuited	Poor: too sandy.
Vebar: [1] VfC, [1] VrB, [1] VrC	Good	Poor: excess fines	Unsuited	Good.
[1] VfD	Good	Poor: excess fines	Unsuited	Fair: slope.
Flasher part of VfC and VfD	Good	Unsuited	Unsuited	Poor: thin layer.
Tally part of VrB and VrC	Fair: frost action	Poor: excess fines	Unsuited	Good.
Wabek: WaE	Good	Fair: excess fines	Fair: excess fines	Poor: thin layer, area reclaim.
Wayden: WyC	Poor: shrink-swell, low strength.	Unsuited	Unsuited	Poor: too clayey.
Yetull: YeE	Fair: slope	Fair: excess fines	Unsuited	Poor: slope, too sandy, area reclaim.
Zeona: ZfC	Poor: area reclaim	Poor: excess fines	Unsuited	Poor: too sandy, thin layer, area reclaim.

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10, soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Soil Properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering Properties

Table 11 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 11 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Descriptions of the Soils."

Texture is described in table 11 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL–ML.

TABLE 10.—*Water management*

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary]

Soil name and map symbol	Soil and site features that affect—					
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Absher: AbA, AbC	Favorable	Low strength, compressible, hard to pack.	Excess alkali, percs slowly, slope.	Excess alkali, percs slowly, slope.	Percs slowly, poor outlets.	Excess alkali, percs slowly, slope.
Amor: AgA, AgB, AgC	Seepage, depth to rock.	Compressible, shrink-swell.	Not needed	Rooting depth	Depth to rock, rooting depth.	Rooting depth.
Arnegard: ArB	Seepage	Piping, compressible, low strength.	Not needed	Favorable	Piping	Favorable.
Badland: [1] BaF (Cabbart part). (Bb and Badland part of BaF not rated.)	Slope, depth to rock.	Low strength, thin layer, hard to pack.	Not needed	Percs slowly, slope.	Complex slope, depth to rock, rooting depth.	Slope, rooting depth, erodes easily.
Belfield: BeA, BeB, BfA, BfB, [1] BhA, [1] BhB.	Favorable	Compressible, hard to pack, shrink-swell.	Not needed	Excess alkali, excess salt, percs slowly.	Percs slowly, erodes easily.	Excess alkali, excess salt, percs slowly.
Rhoades part of BhA and BhB	Favorable	Low strength, compressible, hard to pack.	Not needed	Excess alkali, excess salt, slow intake.	Percs slowly, erodes easily, rooting depth.	Erodes easily, excess alkali, excess salt.
Benz: BkC [1] BnC	Slope	Piping, low strength, hard to pack.	Percs slowly, excess alkali, slope.	Excess alkali, percs slowly, slope.	Percs slowly, piping.	Percs slowly, excess alkali, excess salt.
Absher part of BnC	Favorable	Low strength, compressible, hard to pack.	Excess alkali, percs slowly, slope.	Excess alkali, percs slowly, slope.	Percs slowly, poor outlets.	Excess alkali, percs slowly, slope.
Borolls: Bo	Seepage	Low strength	Wetness	Wetness, excess salt.	Wetness	Wetness.
[1] BrE: Borolls part	Slope	Large stones	Not needed	Slope, large stones.	Slope	Slope.
Orthents part	Depth to rock, slope.	Thin layer, large stones.	Not needed	Slope	Slope	Slope.
Boxwell: BtB	Seepage, depth to rock.	Piping, thin layer, low strength.	Not needed	Slope	Depth to rock, piping.	Rooting depth, erodes easily.
BtC	Slope, seepage, depth to rock.	Piping, thin layer, low strength.	Not needed	Slope	Depth to rock, piping.	Rooting depth, erodes easily.
Brandenburg: [1] BuE: Brandenburg part	Seepage, depth to rock.	Thin layer	Not needed	Droughty, seepage, rooting depth.	Depth to rock, rooting depth, slope.	Droughty, rooting depth.
Cabba part	Slope, seepage, depth to rock.	Thin layer, piping, low strength.	Not needed	Slope	Depth to rock, slope, rooting depth.	Rooting depth, slope, droughty.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Soil and site features that affect—					
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Cabba: CaE, [1] CbE, [1] CcD, [1] CdD.	Slope, seepage, depth to rock.	Thin layer, piping, low strength.	Not needed	Slope	Depth to rock, slope, rooting depth.	Rooting depth, slope, droughty.
Chama part of CcD and CdD (Badland part of CbE not rated.)	Slope	Low strength, piping, hard to pack.	Not needed	Slope, erodes easily.	Slope, piping, erodes easily.	Slope, erodes easily, percs slowly.
Cabbart: CfC, CfD, CfE, [1] CgE. (Badland part of CgE not rated.)	Slope, depth to rock.	Low strength, thin layer, hard to pack.	Not needed	Slope	Complex slope, depth to rock, rooting depth.	Slope, rooting depth, erodes easily.
Chama: CmA, CmB, [1] CoB, [1] CoC, [1] CoD, [1] CrC.	Slope	Low strength, piping, hard to pack.	Not needed	Slope, erodes easily.	Slope, piping, erodes easily.	Slope, erodes easily, percs slowly.
Cabba part of CoB	Slope, seepage, depth to rock.	Thin layer, piping, low strength.	Not needed	Slope	Depth to rock, slope, rooting depth.	Rooting depth, slope, droughty.
Cabba part of CoC	Slope, seepage, depth to rock.	Thin layer, piping, low strength.	Not needed	Rooting depth	Depth to rock, slope, rooting depth.	Rooting depth, slope, droughty.
Cabba part of CoD	Slope, seepage, depth to rock.	Thin layer, piping, low strength.	Not needed	Rooting depth, slope.	Depth to rock, slope, rooting depth.	Rooting depth, slope, droughty.
Cabbart part of CrC	Slope, depth to rock.	Low strength, thin layer, hard to pack.	Not needed	Rooting depth, slope.	Complex slope, depth to rock, rooting depth.	Slope, rooting depth, erodes easily.
Chanta: CtA, CtB	Seepage	Hard to pack, seepage, thin layer.	Not needed	Droughty, seepage, rooting depth.	Rooting depth	Droughty, rooting depth.
Cherry: CyC	Favorable	Compressible, shrink-swell, low strength.	Not needed	Erodes easily, percs slowly, slow intake.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Chinook: CzB	Seepage	Piping, low strength.	Cutbanks cave, slope.	Seepage, erodes easily, slope.	Erodes easily, piping.	Erodes easily.
Daglum: DaB, DaC, [1] DhB	Favorable	Low strength, compressible, shrink-swell.	Not needed	Excess alkali, excess salt, slow intake.	Percs slowly, erodes easily, rooting depth.	Erodes easily, excess alkali, excess salt.
Dimmick: Dk	Favorable	Compressible, hard to pack, low strength.	Wetness, floods, poor outlets.	Wetness, slow intake.	Percs slowly, wetness, poor outlets.	Not needed.
Ekalaka: [1] EdB, [1] EkB, [1] EkC	Favorable	Erodes easily, piping.	Not needed	Erodes easily, excess alkali, percs slowly.	Erodes easily, percs slowly, piping.	Droughty, erodes easily, excess alkali.
Desart part of EdB	Seepage	Erodes easily, piping.	Not needed	Erodes easily, excess alkali, percs slowly.	Erodes easily, percs slowly, piping.	Erodes easily, excess alkali, percs slowly.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Soil and site features that affect—					
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Farland: FaA, FaB	Seepage	Compressible, hard to pack, shrink-swell.	Not needed	Favorable	Favorable	Favorable.
Flasher: [1] FbE, [1] FhD, [1] FhE. (Badland part of FbE not rated.)	Depth to rock, slope.	Thin layer, seepage.	Not needed	Complex slope, droughty, rooting depth.	Slope, depth to rock, erodes easily.	Erodes easily, slope.
Fleak: [1] FkE, [1] FlD [1] FlE (Badland part of FkE not rated.)	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope, rooting depth, seepage.	Depth to rock, soil blowing.	Erodes easily, rooting depth, soil blowing.
Fluvaquentic Haplaquolls: Fu	Favorable	Compressible, low strength.	Poor outlets, floods.	Floods, wetness.	Not needed	Not needed.
Glendive: GlA, GlB	Seepage	Piping, low strength.	Frost action, floods.	Erodes easily, seepage.	Erodes easily, piping.	Erodes easily.
Golva: GoC	Seepage	Low strength, piping, shrink-swell.	Not needed	Favorable	Piping	Favorable.
Grail: GrA, GrB, GtA, GtB.	Favorable	Compressible, low strength, piping.	Not needed	Slow intake	Piping	Favorable.
Grassna: GwA, [1] GxB	Seepage	Compressible, low strength, piping.	Not needed	Favorable	Piping	Favorable.
Golva part of GxB	Seepage	Low strength, piping, shrink-swell.	Not needed	Favorable	Piping	Favorable.
Hanly: HaA	Seepage	Seepage, piping.	Not needed	Droughty, floods, soil blowing.	Not needed	Not needed.
Harriet: [1] Hc	Favorable	Compressible, low strength.	Wetness, floods, percs slowly.	Slow intake, excess alkali, excess salt.	Percs slowly, rooting depth.	Not needed.
Havre: HeA	Seepage	Low strength, piping.	Slope	Slope, erodes easily.	Favorable	Favorable.
Heil: [1] Hz: Heil part	Favorable	Compressible, hard to pack, low strength.	Wetness, floods, percs slowly.	Slow intake, excess alkali.	Not needed	Not needed.
McKenzie part	Favorable	Compressible, shrink-swell, low strength.	Percs slowly, poor outlets, excess alkali.	Floods, excess alkali, percs slowly.	Not needed	Not needed.
Korchea: KcA [1] Kh	Seepage	Piping, shrink-swell.	Not needed	Floods	Piping	Not needed.
Havre part of Kh	Seepage	Low strength, piping.	Slope	Slope, erodes easily.	Favorable	Favorable.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Soil and site features that affect—					
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Kremlin: KrB	Seepage	Piping, hard to pack, low strength.	Percs slowly, slope.	Erodes easily, slope.	Erodes easily	Erodes easily, percs slowly.
KrC	Slope, seepage	Piping, hard to pack, low strength.	Percs slowly, slope.	Erodes easily, slope.	Erodes easily	Erodes easily, percs slowly.
Lawther: LaA, LaB, [1] Lc	Favorable	Compressible, shrink-swell, low strength.	Not needed	Percs slowly, slow intake.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Rhoades part of Lc	Favorable	Low strength, compressible, hard to pack.	Not needed	Excess alkali, excess salt, slow intake.	Percs slowly, erodes easily, rooting depth.	Erodes easily, excess alkali, excess salt.
Lawther variant: LdA, LdC	Seepage	Shrink-swell, low strength.	Not needed	Slow intake	Percs slowly	Percs slowly.
Lefor: [1] LeB, [1] LeC						
Lefor part	Seepage, depth to rock.	Low strength, piping.	Not needed	Rooting depth	Piping, erodes easily.	Slope, erodes easily.
Vebar part	Seepage, depth to rock.	Piping	Not needed	Erodes easily, rooting depth.	Depth to rock	Erodes easily, slope.
Manning: MaA, MaB	Seepage	Seepage	Not needed	Droughty, fast intake, seepage.	Erodes easily, rooting depth.	Erodes easily, rooting depth.
Moreau: MeA, MeB, MeC	Favorable	Compressible, shrink-swell, low strength.	Not needed	Percs slowly, excess alkali, slow intake.	Percs slowly, erodes easily.	Erodes easily, excess alkali, percs slowly.
Morton: MoA, MoB, MoC, [1] MpA, [1] MpB, [1] MpC, [1] MrB, [1] MrC.	Favorable	Compressible, shrink-swell, piping.	Not needed	Percs slowly, rooting depth.	Piping, rooting depth.	Favorable.
Rhoades part of MrB and MrC	Favorable	Low strength, compressible, hard to pack.	Not needed	Excess alkali, excess salt, slow intake.	Percs slowly, erodes easily, rooting depth.	Erodes easily, excess alkali, excess salt.
Mott: MsA, MsB, MtA, MtB.	Seepage	Seepage, piping.	Not needed	Seepage	Favorable	Favorable.
Parshall: PaB	Seepage	Seepage, piping.	Not needed	Favorable	Erodes easily, piping.	Erodes easily.
Patent: PeB, PeD, [1] PsD	Favorable	Piping, shrink-swell, frost action.	Not needed	Slope	Piping, slope	Slope.
Sham part of PsD (Gullied land part of PsD not rated.)	Favorable	Low strength, piping, shrink-swell.	Not needed	Percs slowly, excess alkali.	Erodes easily, piping, percs slowly.	Excess alkali, percs slowly.
Reeder: ReA, ReB, ReC	Seepage, depth to rock.	Compressible, shrink-swell.	Not needed	Rooting depth	Depth to rock, rooting depth.	Rooting depth.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Soil and site features that affect—					
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Regent: RgA, RgB, [1] RhA, [1] RhC	Favorable	Low strength, compressible, shrink-swell.	Not needed	Rooting depth, slow intake, erodes easily.	Percs slowly, rooting depth, erodes easily.	Erodes easily, percs slowly, rooting depth.
Rhoades part of RhA	Favorable	Low strength, compressible, hard to pack.	Not needed	Excess alkali, excess salt, slow intake.	Percs slowly, erodes easily, rooting depth.	Erodes easily, excess alkali, excess salt.
Rhoades part of RhC	Favorable	Low strength, compressible, shrink-swell.	Not needed	Rooting depth, slow intake, erodes easily.	Percs slowly, rooting depth, erodes easily.	Erodes easily, percs slowly, rooting depth.
Rhame: [1] RkB, [1] RkC, [1] RmC, [1] RmD.	Seepage, depth to rock.	Seepage, piping.	Not needed	Erodes easily, rooting depth.	Erodes easily, piping.	Erodes easily, rooting depth.
Chinook part of RkB	Seepage	Piping, low strength.	Cutbanks cave, slope.	Seepage, erodes easily, slope.	Erodes easily, piping.	Erodes easily.
Chinook part of RkC	Seepage, slope	Piping, low strength.	Cutbanks cave, slope.	Seepage, erodes easily, slope.	Erodes easily, piping.	Erodes easily.
Fleak part of RmC and RmD	Slope, seepage, depth to rock.	Thin layer	Not needed	Slope, rooting depth, seepage.	Depth to rock, soil blowing.	Erodes easily, rooting depth, soil blowing.
Rhoades: [1] RsA, [1] RsC, [1] RxB	Favorable	Low strength, shrink-swell, hard to pack.	Not needed	Excess alkali, excess salt, slow intake.	Percs slowly, erodes easily, rooting depth.	Erodes easily, excess alkali, excess salt.
Belfield part of RsA and RsC	Favorable	Compressible, hard to pack, shrink-swell.	Not needed	Excess alkali, excess salt, percs slowly.	Percs slowly, erodes easily.	Excess alkali, excess salt, percs slowly.
Savage: SgA, SgB, [1] ShA	Favorable	Low strength, shrink-swell, hard to pack.	Percs slowly, slope.	Percs slowly, slow intake, slope.	Percs slowly	Percs slowly.
Rhoades part of ShA	Favorable	Low strength, compressible, hard to pack.	Not needed	Excess alkali, excess salt, slow intake.	Percs slowly, erodes easily, rooting depth.	Erodes easily, excess alkali, excess salt.
Searing: SlB, [1] SmB	Depth to rock, seepage.	Shrink-swell, low strength, thin layer.	Not needed	Droughty, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Ringling part of SmB	Seepage, slope	Thin layer, seepage.	Not needed	Droughty, rooting depth.	Slope, rooting depth.	Rooting depth, slope.
Sen: SnA, SnB, SnC, [1] SoB, [1] SoC, [1] SrD.	Seepage, depth to rock.	Low strength, piping, shrink-swell.	Not needed	Rooting depth	Depth to rock, rooting depth.	Rooting depth.
Golva part of SoB and SoC	Seepage	Low strength, piping, shrink-swell.	Not needed	Favorable	Piping	Favorable.

TABLE 10.—*Water management*—Continued

Soil name and map symbol	Soil and site features that affect—					
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Amor part of SrD	Seepage, depth to rock.	Compressible, shrink-swell.	Not needed	Rooting depth	Depth to rock, rooting depth.	Rooting depth.
Sham: [1] SsC	Favorable	Low strength, piping, shrink-swell.	Not needed	Percs slowly, excess alkali.	Erodes easily, piping, percs slowly.	Excess alkali, percs slowly.
Shambo: StA, StB	Seepage	Piping, seepage, shrink-swell.	Not needed	Favorable	Not needed	Not needed.
Stady: SyA, SyB, [1] SzC	Seepage	Seepage, piping.	Not needed	Rooting depth	Rooting depth	Not needed.
Manning part of SzC	Seepage	Seepage	Not needed	Droughty, fast intake, seepage.	Erodes easily, rooting depth.	Erodes easily, rooting depth.
Tally: TaA, TaB	Seepage	Piping	Slope, frost action, cutbanks cave.	Slope, seepage, erodes easily.	Erodes easily	Erodes easily.
Telfer: [1] TeB, [1] TeC: Telfer part	Seepage	Seepage, piping, erodes easily.	Not needed	Droughty, complex slope, soil blowing.	Too sandy, erodes easily, slope.	Droughty, erodes easily.
Lihen part	Seepage, slope	Seepage, unstable fill, piping.	Not needed	Seepage, droughty, erodes easily.	Too sandy, erodes easily, slope.	Erodes easily, slope, droughty.
Vebar: [1] VfC, [1] VfD, [1] VrB, [1] VrC.	Seepage, depth to rock.	Piping	Not needed	Erodes easily, rooting depth.	Depth to rock	Erodes easily, slope.
Flasher part of VfC and VfD	Depth to rock, slope.	Thin layer, seepage.	Not needed	Complex slope, droughty, rooting depth.	Slope, depth to rock, erodes easily.	Erodes easily, slope.
Tally part of VrB	Seepage	Piping	Slope, frost action, cutbanks cave.	Slope, seepage, erodes easily.	Erodes easily	Erodes easily.
Tally part of VrC	Seepage, slope	Piping	Slope, frost action, cutbanks cave.	Slope, seepage, erodes easily.	Erodes easily	Erodes easily.
Wabek: WaE	Seepage	Seepage	Not needed	Droughty, seepage.	Not needed	Droughty, erodes easily.
Wayden: WyC	Depth to rock	Thin layer, shrink-swell, low strength.	Not needed	Percs slowly, slow intake, rooting depth.	Depth to rock, erodes easily, rooting depth.	Droughty, erodes easily, percs slowly.
Yetull: YeE	Seepage, slope	Seepage, piping.	Not needed	Slope, fast intake, seepage.	Erodes easily, slope, too sandy.	Droughty, erodes easily, slope.
Zeona: ZfC	Seepage	Erodes easily, piping, seepage.	Not needed	Fast intake, droughty, soil blowing.	Too sandy, soil blowing, piping.	Slope, erodes easily, droughty.

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

TABLE 11.—*Engineering properties*

[The symbol < means less than and > means more than. Absence of an

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Absher: AbA, AbC	0–5	Loam	ML, CL	A–4, A–6
	5–41	Silty clay, clay, silty clay loam	CL, CH	A–6, A–7
	41–60	Weathered bedrock.		
Amor: AgA, AgB, AgC	0–32	Loam	ML, CL	A–4, A–6
	32–60	Weathered bedrock.		
Arnegard: ArB	0–16	Loam	ML	A–4
	16–40	Loam, silt loam, silty clay loam	ML, CL	A–4, A–6, A–7
	40–60	Fine sandy loam, loamy fine sand	SM, ML	A–4, A–2
Badland:				
[1] BaF (Cabbart part)	0–10	Silt loam	CL, ML	A–4, A–6
(Badland part of BaF too variable to be estimated.)	10–40	Weathered bedrock.		
Bb. (Properties too variable to be estimated.)				
Belfield:				
BeA, BeB	0–8	Silt loam	ML, CL	A–4, A–6
	8–25	Silty clay, silty clay loam	CH	A–7
	25–60	Silty clay loam	CH, CL	A–7
BfA, BfB	0–12	Silty clay loam	CL, CH	A–7
	12–25	Silty clay, silty clay loam	CH	A–7
	25–60	Silty clay loam	CH, CL	A–7
[1] BhA, [1] BhB:				
Belfield part	0–12	Silty clay loam	CL, CH	A–7
	12–25	Silty clay, silty clay loam	CH	A–7
	25–60	Silty clay, silty clay loam, clay loam	CH, CL	A–7
Rhoades part	0–3	Silty clay loam	CL	A–6, A–7
	3–18	Clay loam, silty clay, clay, silty clay loam	CL, CH	A–7
	18–53	Silty clay, clay loam, loam	CL, CH	A–6, A–7
	53–60	Weathered bedrock.		
Benz:				
BkC	0–12	Silt loam	ML	A–4
	12–60	Stratified fine sandy loam to clay loam	CL–ML, CL	A–4, A–6
[1] BnC:				
Benz part	0–12	Clay loam	CL	A–6, A–7
	12–60	Stratified fine sandy loam to clay loam	CL–ML, CL	A–4, A–6
Absher part	0–5	Clay loam	CL, ML	A–4, A–6, A–7
	5–41	Silty clay, clay, silty clay loam	CL, CH	A–6, A–7
	41–60	Weathered bedrock.		
Borolls: Bo, [1] BrE. (Properties too variable to be estimated.)				
Boxwell: BtB, BtC	0–6	Loam	ML, CL	A–4, A–6
	6–26	Silty clay loam, clay loam, loam	CL, ML	A–6, A–4, A–7
	26–37	Silt loam	ML, CL–ML	A–4
	37–60	Weathered bedrock.		
Brandenburg: [1] BuE:				
Brandenburg part	0–10	Channery loam	CL–ML, SM, CL, SM–SC	A–2, A–4
	10–30	Weathered bedrock.		
Cabba part	0–9	Loam	CL, ML	A–4, A–6
	9–17	Silt loam	ML, CL	A–4, A–6
	17–50	Weathered bedrock.		

and classifications

entry indicates that data were not estimated. NP means nonplastic]

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	85–95	60–75	25–40	5–25
0	100	100	90–100	85–95	35–55	20–35
0	100	100	90–100	65–85	20–40	5–20
0	100	100	85–100	60–90	20–40	5–10
0	100	100	85–100	60–95	20–45	5–30
0	100	100	60–80	20–45	10–30	NP–5
0	100	100	90–100	70–90	20–40	5–25
0	100	100	80–100	70–90	20–40	5–25
0	100	100	95–100	85–95	50–70	25–50
0	100	100	90–100	75–95	40–65	20–50
0	100	100	90–100	75–95	40–60	20–40
0	100	100	95–100	85–95	50–70	25–50
0	100	100	90–100	75–95	40–65	20–50
0	100	100	90–100	75–95	40–60	20–40
0	100	100	95–100	85–95	50–70	25–50
0	100	100	90–100	75–95	40–65	20–50
0	100	100	85–100	85–95	30–45	10–25
0	100	100	90–100	80–95	40–75	20–45
0	100	100	85–100	75–95	35–70	20–45
0	100	100	85–100	60–90	10–40	NP–10
0	100	100	80–95	65–80	25–40	5–20
0	100	100	90–100	70–95	25–45	10–25
0	100	100	80–95	65–80	25–40	5–20
0	100	100	85–95	60–85	25–45	5–30
0	100	100	90–100	85–95	35–55	20–35
0	100	100	90–100	70–90	15–35	5–20
0	100	100	90–95	70–85	25–35	5–25
0	100	100	85–95	70–80	15–25	NP–7
0–5	60–100	40–80	35–75	30–65	20–35	5–15
0	100	100	95–100	60–75	20–40	5–25
0–5	100	100	90–100	80–90	20–35	5–20

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Cabba:				
CaE, [1] CbE	0–9	Loam	CL, ML	A–4, A–6
	9–17	Silt loam	ML, CL	A–4, A–6
(Badland part of CbE too variable to be estimated.)	17–50	Weathered bedrock.		
[1] CcD:				
Cabba part	0–9	Loam	CL, ML	A–4, A–6
	9–17	Silt loam	ML, CL	A–4, A–6
	17–50	Weathered bedrock.		
Chama part	0–4	Silt loam	ML, CL	A–4, A–6
	4–34	Silt loam, loam	ML, CL	A–4, A–6
	34–50	Weathered bedrock.		
[1] CdD:				
Cabba part	0–9	Stony loam	CL, ML	A–4, A–6
	9–17	Silt loam	CL, ML	A–4, A–6
	17–50	Weathered bedrock.		
Chama part	0–4	Stony loam	ML, CL	A–4, A–6
	4–34	Silt loam, loam	ML, CL	A–4, A–6
	34–50	Weathered bedrock.		
Cabbart: CfC, CfD, CfE, [1] CgE	0–10	Silt loam	CL, CL–ML	A–4
(Badland part of CgE too variable to be estimated.)	10–40	Weathered bedrock.		
Chama:				
CmA, CmB, [1] CoB, [1] CoC, [1] CoD, [1] CrC.	0–4	Silt loam	ML, CL	A–4, A–6
	4–34	Silt loam, loam	ML, CL	A–4, A–6
	34–50	Weathered bedrock.		
Cabba part of CoB, CoC, and CoD.	0–9	Silt loam	CL, ML	A–4, A–6
	9–17	Silt loam	CL, ML	A–4, A–6
	17–50	Weathered bedrock.		
Cabbart part of CrC	0–10	Silt loam	CL, CL–ML	A–4
	10–40	Weathered bedrock.		
Chanta: CtA, CtB	0–26	Loam	ML, CL	A–4, A–6
	26–60	Sand and gravel	GM, SM	A–1, A–2
Cherry: CyC	0–42	Silty clay loam	CL	A–6, A–7
	42–60	Silty clay	CL, CH	A–7
Chinook: CzB	0–39	Fine sandy loam	SM	A–4
	39–60	Loamy fine sand	SM	A–4, A–2
Daglum:				
DaB, DaC	0–11	Fine sandy loam	SM, ML	A–4
	11–60	Silty clay	CL, CH	A–7
[1] DhB:				
Daglum part	0–11	Silty clay loam	CL	A–6, A–7
	11–60	Silty clay	CL, CH	A–7
Rhoades part	0–3	Silty clay loam	CL	A–6, A–7
	3–18	Clay loam, silty clay, clay, silty clay loam	CL, CH	A–7
	18–53	Silty clay, clay loam, loam	CL, CH	A–6, A–7
	53–60	Weathered bedrock.		
Dimmick: Dk	0–60	Silty clay	CH	A–7
Ekalaka:				
[1] EdB:				
Ekalaka part	0–11	Fine sandy loam	SM, ML	A–4
	11–35	Fine sandy loam, loamy fine sand	SM	A–2, A–4
	35–60	Fine sandy loam, loamy fine sand	SM	A–2, A–4

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	95–100	60–75	20–40	5–25
0–5	100	100	90–100	80–90	20–35	5–20
0	100	100	95–100	60–75	20–40	5–25
0–5	100	100	90–100	80–90	20–35	5–20
0	100	100	90–100	70–90	20–35	5–20
0	100	100	90–100	80–90	20–35	5–20
0–25	95–100	85–100	75–90	60–75	20–40	5–25
0–5	100	100		80–90	20–35	5–20
0–25	95–100	95–100	85–95	60–75	20–35	5–15
0	100	100	90–100	80–90	20–35	5–15
0	100	100	80–100	70–90	20–35	5–20
0	100	100	90–100	70–90	20–35	5–20
0	100	100	90–100	80–90	20–35	5–25
0	100	100	95–100	70–90	20–40	5–20
0–5	100	100	90–100	80–90	20–35	5–20
0	100	100	80–100	70–90	20–35	5–20
0	100	100	85–95	60–75	25–40	5–25
5–20	80–95	75–90	30–55	10–30	10–20	NP–5
0	100	100	90–100	85–95	30–50	15–30
0	100	100	90–100	90–95	30–50	15–40
0	100	100	70–85	35–50	15–30	NP–5
0	100	100	60–80	25–45	----------	NP
0	100	100	75–90	45–65	20–35	5–10
0	100	100	90–100	85–95	40–75	20–45
0	100	100	90–100	70–85	30–45	15–25
0	100	100	90–100	85–95	40–75	20–45
0	100	100	95–100	85–95	30–45	10–25
0	100	100	90–100	80–95	40–75	20–45
0	100	100	85–100	75–95	35–70	20–45
0	100	100	90–100	90–95	50–70	25–45
0	100	100	70–85	40–55	20–35	NP–10
0	100	100	70–85	20–45	20–35	NP–10
0	100	100	70–85	20–45	20–35	NP–10

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Desart part	0–24	Fine sandy loam	SM, SM–SC	A–4
	24–47	Fine sandy loam	SM, ML, SM–SC, CL–ML	A–4
	47–60	Loam	ML, CL	A–4, A–6
[1] EkB, [1] EkC	0–11	Fine sandy loam, sandy loam, loamy fine sand.	SM	A–2, A–4
	11–60	Fine sandy loam, loamy fine sand, fine sand.	SM	A–2, A–4
Farland: FaA, FaB	0–8	Silt loam	CL, CL–ML	A–4, A–6
	8–21	Silty clay loam, clay loam	CL, CH	A–7
	21–40	Silt loam	CL	A–6
	40–60	Stratified silt loam to silty clay loam	CL, ML, CH	A–4, A–6, A–7
Flasher:				
[1] FbE (Badland part too variable to be estimated.)	0–5	Sandy loam	SM	A–2, A–4
	5–15	Loamy sand, fine sand	SM	A–2
	15–60	Weathered bedrock.		
[1] FhD, [1] FhE	0–5	Loamy fine sand, sandy loam, fine sandy loam.	SM	A–2, A–4
	5–15	Loamy sand, loamy fine sand, fine sand	SM	A–2
	15–60	Weathered bedrock.		
Fleak:				
[1] FkE (Badland part too variable to be estimated.)	0–4	Loamy fine sand	SM	A–4, A–2
	4–19	Loamy fine sand	SM	A–2, A–4
	19–60	Weathered bedrock.		
[1] FlD, [1] FlE	0–4	Loamy fine sand, sandy loam, fine sandy loam.	SM	A–4, A–2
	4–19	Loamy fine sand	SM	A–2, A–4
	19–60	Weathered bedrock.		
Fluvaquentic Haplaquolls: Fu. (Properties too variable to be estimated.)				
Glendive: GlA, GlB	0–12	Fine sandy loam	ML, CL–ML	A–4
	12–60	Stratified fine sandy loam to loamy fine sand.	SM	A–4, A–2
Golva: GoC	0–5	Silt loam	ML, CL	A–4, A–6
	5–60	Silt loam	ML, CL	A–4, A–6
Grail:				
GrA, GrB	0–12	Silt loam	ML, CL	A–4, A–6, A–7
	12–27	Silty clay	CL, CH	A–7
	27–60	Silty clay loam	CL	A–6, A–7
GtA, GtB	0–12	Silty clay loam	CL	A–6, A–7
	12–27	Silty clay	CL, CH	A–7
	27–60	Silty clay loam	CL	A–6, A–7
Grassna:				
GwA, [1] GxB	0–60	Silt loam	ML, CL	A–4, A–6
Golva part of GxB	0–60	Silt loam	ML, CL	A–4, A–6
Hanly: HaA	0–5	Loamy sand, loamy fine sand, sandy loam	SM	A–2, A–4
	5–60	Stratified fine sandy loam to loamy sand	SM, SP–SM	A–4, A–2, A–3
Harriet: [1] Hc	0–4	Very fine sandy loam, silt loam, loam	ML, CL	A–4, A–6
	4–19	Clay loam, silty clay	CL, CH	A–7, A–6
	19–60	Silty clay loam, silty clay	CL, CH	A–7

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	60–85	40–50	20–35	NP–10
0	100	100	70–90	40–55	25–40	NP–10
0	100	100	85–95	60–75	20–35	5–15
0	100	100	70–85	30–50	20–35	NP–10
0	100	100	50–75	30–40	20–35	NP–10
0	100	100	85–100	70–90	20–40	5–25
0	100	100	90–100	75–95	40–60	15–35
0	100	100	85–100	70–90	30–50	10–30
0	100	100	75–100	60–95	20–60	5–40
0–5	100	95–100	60–70	30–40	----------	NP
0–5	100	95–100	50–75	15–30	----------	NP
0–5	100	95–100	50–80	15–45	----------	NP
0–5	100	95–100	50–80	15–35	----------	NP
0–5	95–100	95–100	60–80	20–40	----------	NP
0–5	95–100	95–100	65–85	20–40	----------	NP
0–5	95–100	95–100	55–85	20–45	NP–30	NP
0–5	95–100	95–100	65–85	20–40	----------	NP
0	100	100	80–90	55–70	20–35	5–10
0	95–100	75–100	60–80	25–45	15–30	NP–5
0	100	100	90–100	70–85	20–40	5–25
0	100	100	90–100	70–90	30–40	5–25
0	100	100	90–100	70–90	20–40	5–25
0	100	100	95–100	90–95	40–60	15–35
0	100	100	95–100	85–95	25–50	15–30
0	100	100	95–100	85–95	20–45	10–30
0	100	100	95–100	90–95	40–50	15–30
0	100	100	85–100	85–95	25–50	15–30
0	100	100	90–100	70–90	20–40	5–25
0	100	100	90–100	70–85	20–40	5–25
0	100	100	55–80	20–45	NP–30	NP–5
0	100	100	50–85	5–45	----------	NP
0	100	100	85–100	55–90	15–40	5–20
0	100	100	90–100	70–95	25–70	10–50
0	100	100	90–100	70–95	25–70	10–50

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Havre: HeA	0–6	Loam, silt loam, silty clay loam	ML, CL	A–4, A–6
	6–60	Loam, fine sandy loam, silt loam	ML	A–4
Heil: [1] Hz:				
Heil part	0–3	Silty clay	CH	A–7
	3–60	Silty clay	CH	A–7
McKenzie part	0–60	Clay	CH	A–7
Korchea:				
KcA	0–6	Loam	CL, CL–ML	A–4, A–6
	6–60	Stratified loamy fine sand to silty clay loam.	SM, ML, CL, CH	A–4, A–6, A–7
[1] Kh:				
Korchea part	0–6	Loam, silt loam	CL, CL–ML	A–4, A–6
	6–60	Stratified fine sandy loam to silt loam	SM, ML, CL	A–4, A–6
Havre part	0–6	Loam, silt loam	ML, CL–ML	A–4, A–6
	6–60	Loam, fine sandy loam, silt loam	ML	A–4
Kremlin: KrB, KrC	0–50	Loam	CL–ML, CL	A–4, A–6
	50–60	Sandy clay loam	CL, SC	A–6
Lawther:				
LaA, LaB, [1] Lc	0–60	Silty clay	CL, CH	A–7
Rhoades part of Lc	0–3	Silty clay	CL, CH	A–7
	3–18	Clay loam, silty clay, clay, silty clay loam	CL, CH	A–7
	18–53	Silty clay, clay loam, loam	CL, CH	A–6, A–7
	53–60	Weathered bedrock.		
Lawther variant: LdA, LdC	0–26	Clay	CH	A–7
	26–36	Sandy clay loam	CL, SC	A–6
	36–60	Loamy coarse sand, loamy sand, coarse sand.	SM	A–2
Lefor:				
[1] LeB:				
Lefor part	0–12	Fine sandy loam	SM, ML	A–4
	12–34	Loam, clay loam	ML, CL	A–6, A–4
	34–60	Weathered bedrock.		
Vebar part	0–36	Fine sandy loam	SM, ML	A–4
	36–60	Weathered bedrock.		
[1] LeC:				
Lefor part	0–12	Fine sandy loam	SM, ML	A–4
	12–34	Loam, clay loam	ML, CL	A–6, A–4
	34–60	Weathered bedrock.		
Vebar part	0–36	Fine sandy loam	SM, ML	A–4, A–2
	36–60	Weathered bedrock.		
Manning: MaA, MaB	0–5	Fine sandy loam	SM	A–2, A–4
	5–33	Fine sandy loam, loam	SM, ML, CL	A–2, A–4, A–6
	33–60	Sand and gravel	GM, SM	A–1, A–2
Moreau: MeA, MeB, MeC	0–6	Silty clay	CH	A–7
	6–29	Silty clay	CH	A–7
	29–60	Weathered bedrock.		
Morton:				
MoA, MoB, MoC, [1] MrB, [1] MrC	0–8	Silt loam	ML, CL	A–4, A–6
	8–24	Silty clay loam	CL	A–6, A–7
	24–36	Silty clay loam	CL	A–6, A–7
	36–60	Weathered bedrock.		

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	80–100	60–95	20–40	5–20
0	100	100	80–95	60–75	15–25	5–15
0	100	100	90–100	75–95	50–70	25–45
0	100	100	90–100	75–95	50–70	25–45
0	100	100	90–100	75–95	50–75	25–50
0	100	100	75–95	50–70	15–30	5–15
0	100	100	70–100	40–95	20–60	NP–35
0	100	100	85–95	60–85	15–30	5–15
0	100	100	70–100	40–95	20–60	NP–25
0	100	100	80–95	60–85	20–30	5–15
0	100	100	80–95	60–75	15–25	NP–5
0	100	85–100	85–95	60–75	20–35	5–15
0	100	85–100	80–90	35–55	20–35	5–15
0	100	100	95–100	90–95	40–70	25–45
0	100	100	90–100	90–95	40–75	20–45
0	100	100	90–100	80–95	40–75	20–45
0	100	100	85–100	75–95	35–70	20–45
0	100	100	90–100	85–100	50–75	25–50
0	100	100	65–75	45–55	25–40	10–25
0	100	100	50–75	10–30	----------	NP
0	100	100	70–85	40–55	10–25	NP–5
0	100	100	85–100	60–80	20–40	5–25
0	100	100	70–85	40–55	----------	NP
0	100	100	70–85	40–55	10–25	NP–5
0	100	100	80–90	35–55	20–40	5–25
0	100	100	60–85	30–55	----------	NP
0	95–100	95–100	70–85	40–50	----------	NP
0–3	85–100	80–100	60–95	30–70	<35	NP–15
0–5	25–75	15–65	10–40	5–25	----------	NP
0	100	100	90–100	75–95	50–75	25–50
0	100	100	90–100	75–95	50–75	25–50
0	100	100	90–100	70–90	20–40	5–25
0	100	100	95–100	85–95	25–50	10–30
0	100	100	95–100	85–95	25–50	10–30

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Rhoades part of MrB and MrC.	0–3	Silt loam	CL	A–6
	3–18	Clay loam, silty clay, clay, silty clay loam	CL, CH	A–7
	18–53	Silty clay, clay loam, loam	CL, CH	A–6, A–7
	53–60	Weathered bedrock.		
[1] MpA, [1] MpB, [1] MpC	0–8	Silty clay loam	CL	A–6, A–7
	8–24	Silty clay loam	CL	A–6, A–7
	24–36	Silty clay loam	CL	A–6, A–7
	36–60	Weathered bedrock.		
Mott:				
MsA, MsB	0–46	Sandy loam, fine sandy loam	SM, ML	A–2, A–4
	46–60	Loamy coarse sand, coarse sand	SM	A–2
MtA, MtB	0–46	Loam, fine sandy loam	SM, ML	A–2, A–4
	46–60	Loamy coarse sand, coarse sand	SM	A–2
Parshall: PaB	0–8	Fine sandy loam	SM, ML	A–4, A–2
	8–60	Fine sandy loam, sandy loam, loamy fine sand.	SM, ML	A–4, A–2
Patent:				
PeB, PeD, [1] PsD	0–4	Loam	ML, CL	A–4, A–6
	4–60	Loam	ML	A–4, A–6
Sham part of PsD (Gullied land part of PsD too variable to be estimated.)	0–6	Loam	ML	A–4
	6–60	Stratified fine sandy loam, silty clay loam	ML, SM, CL	A–4, A–2 A–7, A–6
Reeder: ReA, ReB, ReC	0–8	Loam	ML	A–4, A–6
	8–38	Clay loam, loam	ML, CL	A–4, A–6, A–7
	38–60	Weathered bedrock.		
Regent:				
RgA, RgB, [1] RhA	0–36	Silty clay loam, silty clay	CL, CH	A–7
	36–60	Weathered bedrock.		
[1] RhC	0–36	Silty clay loam	CL, CH	A–6, A–7
	36–60	Weathered bedrock.		
Rhoades part of RhA and RhC	0–3	Silty clay loam	CL, CH	A–6, A–7
	3–18	Clay loam, silty clay loam, clay, silty clay	CL, CH	A–7
	18–53	Silty clay, clay loam, loam	CL, CH	A–6, A–7
	53–60	Weathered bedrock.		
Rhame:				
[1] RkB, [1] RkC, [1] RmC, [1] RmD	0–5	Fine sandy loam	SM, ML	A–4
	5–29	Fine sandy loam	SM, ML	A–4
	29–35	Fine sandy loam	SM, ML	A–4
	35–60	Weathered bedrock.		
Chinook part of RkB and RkC.	0–39	Fine sandy loam	SM	A–4
	39–60	Loamy fine sand	SM	A–4, A–2
Fleak part of RmC and RmD.	0–4	Fine sandy loam	SM	A–4
	4–19	Loamy fine sand	SM	A–2, A–4
	19–60	Weathered bedrock.		
Rhoades:				
[1] RsA, [1] RsC, [1] RxB	0–3	Loam	ML, CL	A–4, A–6
	3–18	Clay loam, silty clay, clay, silty clay loam	CL, CH	A–7
	18–53	Silty clay, clay loam, loam	CL, CH	A–6, A–7
	53–60	Weathered bedrock.		
Belfield part of RsA	0–12	Silt loam	ML, CL	A–4, A–6
	12–25	Silty clay, silty clay loam	CH	A–7
	25–60	Silty clay, silty clay loam, clay loam	CH, CL	A–7

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	90–100	70–85	25–40	10–25
0	100	100	90–100	80–95	40–75	20–45
0	100	100	85–100	75–95	35–70	20–45
0	100	100	90–100	70–90	30–40	10–30
0	100	100	95–100	85–95	25–50	10–30
0	100	100	95–100	85–95	25–50	10–30
0	95–100	95–100	60–85	30–55	20–35	NP–10
0	100	100	45–65	10–25	----------	NP
0	95–100	95–100	60–85	30–55	20–35	NP–10
0	100	100	45–65	15–25	----------	NP
0	100	100	70–85	40–55	----------	NP
0	100	100	60–80	30–55	----------	NP
0	100	100	85–100	50–80	20–35	5–15
0	100	100	85–100	60–80	20–35	5–15
0	100	100	85–95	60–75	15–30	NP–5
0	100	100	60–95	30–75	15–50	NP–30
0	100	100	90–100	65–85	20–40	5–20
0	100	100	90–100	60–80	25–50	5–30
0	100	100	90–100	85–95	40–70	20–45
0	100	100	90–100	85–95	30–70	15–45
0	100	100	95–100	85–95	30–40	10–25
0	100	100	90–100	80–95	40–75	20–45
0	100	100	85–100	75–95	35–70	20–45
0	100	100	70–85	40–55	15–30	NP–5
0	100	100	70–85	40–55	15–30	NP–5
0	100	100	70–85	40–55	15–30	NP–5
0	100	100	70–85	35–50	15–30	NP–5
0	100	100	60–80	25–45	----------	NP
0–5	95–100	95–100	70–85	40–50	15–30	NP–5
0–5	95–100	95–100	65–85	20–40	----------	NP
0	100	100	85–95	60–75	20–35	5–10
0	100	100	90–100	80–95	40–75	20–45
0	100	100	85–100	75–95	35–70	20–40
0	100	100	80–100	70–90	20–40	5–25
0	100	100	95–100	85–95	50–70	25–50
0	100	100	90–100	75–95	40–65	20–50

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Belfield part of RsC	0–12	Silt loam	ML, CL	A–4, A–6
	12–25	Silty clay, silty clay loam	CH	A–7
	25–60	Silty clay, silty clay loam, clay loam	CH, CL	A–7
Savage:				
SgA, SgB	0–6	Silty clay loam	CL	A–6, A–7
	6–60	Silty clay	CL, CH	A–7
[1] ShA:				
Savage part	0–6	Silty clay loam	CL	A–6, A–7
	6–60	Silty clay, silty clay loam	CL, CH	A–7
Rhoades part	0–3	Silty clay loam	CL	A–6, A–7
	3–18	Clay loam, silty clay, clay, silty clay loam	CL, CH	A–7
	18–53	Silty clay, clay loam, loam	CL, CH	A–6, A–7
	53–60	Weathered bedrock.		
Searing:				
SlB, [1] SmB	0–6	Loam	ML	A–4
	6–23	Loam	CL	A–6, A–4
	23–40	Unweathered bedrock.		
Ringling part of SmB	0–10	Channery loam	GM	A–4
	10–40	Weathered bedrock.		
Sen:				
SnA, SnB, SnC, [1] SoB, [1] SoC, [1] SrD.	0–34	Silt loam	ML, CL	A–4, A–6
	34–60	Weathered bedrock.		
Golva part of SoB	0–5	Silt loam	ML, CL	A–4, A–6
	5–60	Silt loam	ML, CL	A–4, A–6
Golva part of SoC	0–5	Silt loam	ML, CL	A–4, A–6
	5–60	Silt loam	ML, CL	A–4, A–6
Amor part of SrD	0–32	Loam	ML, CL	A–4
	32–60	Weathered bedrock.		
Sham: [1] SsC	0–6	Loam	ML	A–4, A–2
	6–60	Stratified fine sandy loam to silty clay loam.	ML, SM, CL	A–7, A–6
Shambo: StA, StB	0–41	Loam	ML, CL	A–4, A–6
	41–60	Gravelly sandy loam, loamy fine sand	SM	A–2, A–4
Stady:				
SyA, SyB, [1] SzC	0–29	Loam	ML, CL	A–4, A–6
	29–60	Sand and gravel	SM, SP, GM, GP	A–1
Manning part of SzC	0–5	Fine sandy loam	SM	A–4
	5–33	Fine sandy loam, loam	SM, ML, CL	A–2, A–4, A–6
	33–60	Sand and gravel	GM, SM	A–1, A–2
Tally: TaA, TaB	0–42	Fine sandy loam	SM	A–4
	42–60	Loamy fine sand	SM	A–2
Telfer: [1] TeB, [1] TeC:				
Telfer part	0–7	Loamy fine sand	SM	A–2
	7–60	Fine sand, loamy fine sand	SM	A–2
Lihen part	0–60	Loamy fine sand	SM	A–2, A–4
Vebar:				
[1] VfC, [1] VfD:				
Vebar part	0–36	Fine sandy loam	SM, ML	A–4
	36–60	Weathered bedrock.		

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0	100	100	90–100	70–90	20–40	5–25
0	100	100	95–100	85–95	50–70	25–50
0	100	100	90–100	75–95	40–65	20–50
0	100	100	95–100	85–95	30–45	10–25
0	100	100	95–100	85–95	40–60	20–40
0	100	100	95–100	85–95	30–45	11–25
0	100	100	95–100	85–95	40–60	20–40
0	100	100	90–100	70–85	30–45	10–25
0	100	100	90–100	80–95	40–75	20–45
0	100	100	85–100	75–95	35–70	20–40
0	100	100	85–95	65–75	20–35	NP–10
0	100	100	85–100	65–85	20–35	5–25
0–10	60–70	50–70	50–60	35–50	10–40	NP–4
0	100	100	90–100	70–85	25–40	5–25
0	100	100	90–100	70–85	20–40	5–25
0	100	100	90–100	70–90	30–40	5–30
0	100	100	90–100	70–85	20–40	5–25
0	100	100	90–100	70–90	30–40	5–25
0	100	100	85–95	60–75	20–40	5–20
0	100	100	85–95	60–75	15–30	NP–5
0	100	100	70–100	40–95	20–50	5–30
0	100	100	85–95	60–75	15–40	5–25
0	85–100	80–90	40–70	15–40	15–30	NP–5
0–1	95–100	95–100	85–95	60–75	25–40	5–20
0–1	50–100	50–95	10–30	2–15	----------	NP
0	95–100	95–100	70–85	40–50	----------	NP
0–3	85–100	80–100	60–95	30–70	<35	NP–15
0–5	25–75	15–65	10–40	5–25	----------	NP
0	100	100	70–85	40–50	15–30	NP–5
0	100	100	55–80	20–35	----------	NP
0	100	100	50–80	15–35	----------	NP
0	100	100	50–80	15–35	----------	NP
0	100	100	50–85	15–50	10–30	NP–5
0	100	100	70–85	40–55	----------	NP

TABLE 11.—*Engineering properties*

Soil name and map symbol	Depth	USDA texture	Classification	
			Unified	AASHTO
	In			
Flasher part	0–5	Fine sandy loam	SM	A–4
	5–15	Loamy sand, loamy fine sand, fine sand	SM	A–2
	15–60	Weathered bedrock.		
[1] VrB:				
Vebar part	0–36	Fine sandy loam	SM, ML	A–4
	36–60	Weathered bedrock.		
Tally part	0–42	Fine sandy loam	SM	A–4
	42–60	Loamy fine sand	SM	A–2
[1] VrC:				
Vebar part	0–36	Fine sandy loam	SM, ML	A–4
	36–60	Weathered bedrock.		
Tally part	0–42	Fine sandy loam	SM	A–4
	42–60	Loamy fine sand	SM	A–2
Wabek: WaE	0–4	Loam	ML	A–4
	4–8	Gravelly loam	SM	A–2, A–4
	8–60	Gravelly coarse sandy loam, sand, gravel	SM, SP	A–1, A–2
Wayden: WyC	0–12	Silty clay	CH, CL	A–7
	12–60	Weathered bedrock.		
Yetull: YeE	0–11	Loamy coarse sand	SM	A–2
	11–60	Coarse sand	SP–SM, SP, SM	A–1
Zeona: ZfC	0–5	Loamy fine sand	SM, SP–SM	A–2
	5–60	Fine sand	SM, SP–SM	A–2

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A–1 are coarse grained and low in content of fines. At the other extreme, in group A–7, are fine-grained soils. Highly organic soils are classified in group A–8 on the basis of visual inspection.

When laboratory data are available, the A–1, A–2, and A–7 groups are further classified as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 11. Also in table 11 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and in plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and Chemical Properties

Table 12 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on

and classifications—Continued

Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
	4	10	40	200		
Pct					*Pct*	
0–5	100	95–100	70–85	40–50		NP
0–5	100	95–100	50–75	15–30		NP
0	100	100	60–85	40–55		NP
0	100	100	70–85	40–50	15–30	NP–5
0	100	100	55–80	20–35		NP
0	100	100	70–85	40–55		NP
0	100	100	70–85	40–50	15–30	NP–5
0	100	100	55–80	20–35		NP
0–1	90–100	90–100	75–90	50–70	25–40	NP–10
0–1	50–100	50–95	50–65	20–40		NP
0–1	50–100	50–95	10–30	2–15		NP
0	100	100	90–100	85–95	40–75	20–50
0	100	100	50–75	15–30		NP
0	100	100	40–50	0–15		NP
0	100	100	60–80	10–35	<25	NP–5
0	100	100	65–80	20–35		NP

field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 12. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and

TABLE 12.—*Physical and chemical*

[The symbol < means less than and > means more than.

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Absher: AbA, AbC	0–5	<0.06	0.12–0.16	7.4–8.4
	5–41	<0.06	0.13–0.17	7.4–>8.5
	41–60			
Amor: AgA, AgB, AgC	0–32	0.6–2.0	0.20–0.23	6.1–7.3
	32–60			
Arnegard: ArB	0–16	0.6–2.0	0.20–0.24	6.6–7.3
	16–40	0.6–2.0	0.16–0.22	6.6–7.3
	40–60	0.6–2.0	0.14–0.18	6.6–8.4
Badland: [1] BaF (Cabbart part)	0–10	0.6–2.0	0.16–0.22	7.4–8.4
(Badland part too variable to be estimated.)	10–40			
Bb (Properties too variable to be estimated.)				
Belfield:				
BeA, BeB	0–8	0.2–2.0	0.20–0.23	6.1–7.3
	8–25	0.2–0.6	0.14–0.18	6.6–7.8
	25–60	0.06–0.6	0.13–0.16	7.9–9.0
BfA, BfB, [1] BhA, [1] BhB	0–12	0.2–2.0	0.17–0.22	6.1–7.3
	12–25	0.2–0.6	0.14–0.18	6.6–7.8
	25–60	0.06–0.6	0.13–0.16	7.9–9.0
Rhoades part of BhA and BhB	0–3	0.6–2.0	0.15–0.17	6.1–7.3
	3–18	<0.2	0.10–0.12	7.4–9.0
	18–53	<0.2	0.10–0.12	7.9–9.0
	53–60			
Benz:				
BkC	0–12	0.6–2.0	0.14–0.18	>8.5
	12–60	<0.06–0.2	0.14–0.18	>8.5
[1] BnC:				
Benz part	0–12	0.06–0.2	0.14–0.16	>8.5
	12–60	<0.06–0.2	0.14–0.18	>8.5
Absher part	0–5	<0.06	0.12–0.16	7.9–8.4
	5–41	<0.06	0.13–0.17	>8.5
	41–60			
Borolls: Bo, [1] BrE (Properties too variable to be estimated.)				
Boxwell: BtB, BtC	0–6	0.6–2.0	0.16–0.20	6.6–7.3
	6–26	0.6–2.0	0.16–0.18	6.6–7.8
	26–37	0.6–2.0	0.16–0.20	7.4–8.4
	37–60			
Brandenburg: [1] BuE:				
Brandenburg part	0–10	0.6–6.0	0.18–0.20	6.6–7.8
	10–30			
Cabba part	0–9	0.6–2.0	0.15–0.22	6.6–7.8
	9–17	0.6–2.0	0.12–0.19	7.9–8.4
	17–50			
Cabba: CaE, [1] CbE, [1] CcD	0–9	0.6–2.0	0.15–0.22	6.6–7.8
(Badland part of CbE too variable to be estimated.)	9–17	0.6–2.0	0.12–0.19	7.9–8.4
	17–50			
Chama part of CcD	0–4	0.6–2.0	0.16–0.20	6.6–7.8
	4–34	0.2–0.6	0.16–0.20	6.6–8.4
	34–50			

properties of soils

Absence of an entry indicates that data were not estimated]

Salinity	Shrink-swell potential	Risk of corrosion		Wind erodibility group
		Uncoated steel	Concrete	
Mmhos/cm				
4–16	High	High	Low	4
>8	High	High	Low	
<2	Moderate	High	Moderate	6
<2	Low	High	Low	6
<2	Low	High	Low	
<2	Low	High	Low	
<4	Low	High	Low	5
<2	Moderate	High	Low	6
<2	High	High	Moderate	
4–16	High	High	Low	
<2	Moderate	High	Low	7
<2	High	High	Moderate	
4–16	High	High	Low	
<2	Moderate	High	Low	6
2–16	High	High	Low	
8–16	High	High	Low	
4–8	Low	High	Low	6
8–16	Moderate	High	Low	
4–8	Moderate	High	Low	7
8–16	Moderate	High	Low	
4–16	High	High	Low	4
>8	High	High	Low	
<2	Low	High	Low	6
<2	Moderate	High	Low	
<4	Low	High	Low	
<2	Low	High	Moderate	6
<4	Moderate	High	Low	6
2–8	Moderate	High	Low	
<4	Moderate	High	Low	6
2–8	Moderate	High	Low	
<2	Low	High	Low	6
<4	Low	High	Low	

TABLE 12.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
[1] CdD:				
Cabba part	0–9	0.6–2.0	0.12–0.15	6.6–7.8
	9–17	0.6–2.0	0.12–0.19	7.9–8.4
	17–50			
Chama part	0–4	0.6–2.0	0.16–0.20	6.6–7.8
	4–34	0.2–0.6	0.16–0.20	6.6–8.4
	34–50			
Cabbart: CfC, CfD, CfE, [1] CgE (Badland part of CgE too variable to be estimated.)	0–10	0.6–2.0	0.16–0.22	7.4–8.4
	10–40			
Chama: CmA, CmB, [1] CoB, [1] CoC, [1] CoD, CrC	0–4	0.6–2.0	0.16–0.20	6.6–7.8
	4–34	0.2–0.6	0.16–0.20	6.6–8.4
	34–50			
Cabba part of CoB, CoC, and CoD	0–9	0.6–2.0	0.15–0.22	6.6–7.8
	9–17	0.6–2.0	0.12–0.19	7.9–8.4
	17–50			
Cabbart part of CrC	0–10	0.6–2.0	0.16–0.22	7.4–8.4
	10–40			
Chanta: CtA, CtB	0–26	0.6–2.0	0.18–0.21	6.1–7.8
	26–60	>6.0	0.03–0.05	7.4–8.4
Cherry: CyC	0–42	0.2–0.6	0.19–0.22	6.6–8.4
	42–60	0.06–0.6	0.14–0.18	7.9–9.0
Chinook: CzB	0–39	2.0–6.0	0.14–0.18	6.6–7.8
	39–60	2.0–6.0	0.06–0.12	7.4–8.4
Daglum:				
DaB, DaC	0–11	0.6–6.0	0.13–0.15	6.1–7.3
	11–60	<0.2	0.12–0.14	6.6–9.0
[1] DhB:				
Daglum part	0–11	0.6–2.0	0.16–0.18	6.1–7.3
	11–60	<0.2	0.12–0.14	6.6–9.0
Rhoades part	0–3	0.6–2.0	0.15–0.17	6.1–7.3
	3–18	<0.2	0.10–0.12	7.4–9.0
	18–53	<0.2	0.10–0.12	7.9–9.0
	53–60			
Dimmick: Dk	0–60	<0.06	0.13–0.18	5.6–7.8
Ekalaka:				
[1] EdB:				
Ekalaka part	0–13	2.0–6.0	0.13–0.20	6.1–8.4
	13–35	0.06–0.2	0.11–0.13	7.9–9.0
	35–60	0.06–6.0	0.06–0.08	7.9–9.0
Desart part	0–24	2.0–6.0	0.13–0.15	6.1–8.4
	24–47	0.06–0.2	0.12–0.14	6.6–9.0
	47–60	0.06–6.0	0.08–0.10	7.9–9.0
[1] EkB, [1] EkC	0–11	0.06–0.2	0.11–0.13	8.5–9.0
	11–60	0.06–6.0	0.06–0.08	7.9–9.0
Farland: FaA, FaB	0–8	0.6–2.0	0.19–0.21	6.1–7.3
	8–21	0.6–2.0	0.16–0.20	6.6–7.8
	21–40	0.6–2.0	0.17–0.20	6.6–8.4
	40–60	0.2–2.0	0.16–0.18	7.9–9.0
Flasher: [1] FbE, [1] FhD, [1] FhE (Badland part of FbE too variable to be estimated.)	0–5	6.0–20.0	0.08–0.12	6.6–7.8
	5–15	6.0–20.0	0.08–0.12	7.4–7.8
	15–60			

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Wind erodibility group
		Uncoated steel	Concrete	
Mmhos/cm				
<4	Moderate	High	Low	6
2–8	Moderate	High	Low	
<2	Low	High	Low	6
<4	Low	High	Low	
<4	Low	High	Low	5
<2	Low	High	Low	6
<4	Low	High	Low	
<4	Moderate	High	Low	6
2–8	Moderate	High	Low	
<4	Low	High	Low	5
<2	Moderate	High	Moderate	6
<2	Low	Moderate	Low	
<2	Moderate	High	Moderate	7
<2	Moderate	High	Moderate	
<2	Low	High	Low	3
<2	Low	High	Low	
<2	Low	High	Low	3
2–8	High	High	Low	
<2	Moderate	High	Low	6
2–8	High	High	Low	
<2	Moderate	High	Low	6
2–16	High	High	Low	
8–16	High	High	Low	
<2	High	High	Low	4
<2	Low	High	Moderate	3
2–8	Low	High	Moderate	
4–16	Low	High	Moderate	
<2	Low	High	Moderate	3
2–8	Low	High	Moderate	
4–16	Low	High	Moderate	
2–8	Low	High	Moderate	3
4–16	Low	High	Moderate	
<2	Low	High	Moderate	6
<2	Moderate	High	Moderate	
0–4	Moderate	High	Moderate	
0–8	Moderate	High	Moderate	
<2	Low	Moderate	Low	2
<2	Low	Moderate	Low	

TABLE 12.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Fleak: [1] FkE, [1] FlD, [1] FlE (Badland part of FkE too variable to be estimated.)	0–4 4–19 19–60	2.0–6.0 6.0–20.0	0.13–0.16 0.06–0.10	6.6–7.8 6.6–8.4
Fluvaquentic Haplaquolls: Fu. (Properties too variable to be estimated.)				
Glendive: GlA, GlB	0–12 12–60	0.6–2.0 2.0–6.0	0.14–0.20 0.14–0.16	6.6–8.4 7.4–9.0
Golva: GoC	0–5 5–60	0.6–2.0 0.6–2.0	0.20–0.23 0.16–0.20	6.6–7.8 7.4–8.4
Grail: GrA, GrB	0–12 12–27 27–60	0.2–0.6 0.2–0.6 0.2–0.6	0.22–0.24 0.14–0.17 0.13–0.22	6.6–7.3 6.6–7.8 7.4–8.4
GtA, GtB	0–12 12–27 27–60	0.2–0.6 0.2–0.6 0.2–0.6	0.18–0.23 0.14–0.17 0.13–0.22	6.6–7.3 6.6–7.8 7.4–8.4
Grassna: GwA, [1] GxB	0–15 15–60	0.6–2.0 0.6–2.0	0.22–0.24 0.16–0.22	6.6–7.8 6.6–8.4
Golva part of GxB	0–5 5–60	0.6–2.0 0.6–2.0	0.20–0.23 0.16–0.20	6.6–7.8 7.4–8.4
Hanly: [1] HaA	0–5 5–60	6.0–20 6.0–20	0.08–0.12 0.05–0.14	6.6–7.8 6.6–7.8
Harriet: [1] Hc	0–4 4–19 19–60	0.06–0.2 0.06–0.2 0.06–0.2	0.20–0.24 0.15–0.23 0.14–0.18	7.9–8.4 8.5–9.0 7.9–9.0
Havre: HeA	0–6 6–60	0.6–2.0 0.6–2.0	0.16–0.20 0.14–0.20	7.4–8.4 7.4–8.4
Heil: [1] Hz: Heil part	0–3 3–60	<0.06 <0.06	0.15–0.24 0.13–0.18	6.6–7.3 7.4–9.0
McKenzie part	0–60	<0.06	0.13–0.17	7.9–9.0
Korchea: KcA, [1] Kh	0–6 6–60	0.6–2.0 0.6–2.0	0.17–0.21 0.16–0.18	6.6–8.4 7.4–8.4
Havre part of Kh	0–6 6–60	0.6–2.0 0.6–2.0	0.16–0.20 0.14–0.20	7.4–8.4 7.4–8.4
Kremlin: KrB, KrC	0–50 50–60	0.6–2.0 0.2–0.6	0.16–0.20 0.16–0.18	6.6–7.8 7.4–8.4
Lawther: LaA, LaB, [1] Lc	0–60	0.06–0.2	0.14–0.17	7.4–9.0
Rhoades part of Lc	0–3 3–18 18–53 53–60	<0.2 <0.2 <0.2	0.10–0.12 0.10–0.12 0.10–0.12	6.1–7.3 7.4–9.0 7.9–9.0
Lawther variant: LdA, LdC	0–26 26–36 36–60	0.06–0.2 0.2–2.0 6.0–20	0.15–0.18 0.18–0.20 0.10–0.12	6.1–7.8 7.4–8.4 7.9–8.4

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Wind erodibility group
		Uncoated steel	Concrete	
Mmhos/cm				
				3
<2	Low	Moderate	Moderate	
<2	Low	Moderate	Moderate	
<4	Low	High	Low	5
2–8	Low	High	Low	
<2	Moderate	High	Moderate	6
<2	Moderate	High	Moderate	
<2	Moderate	High	Low	6
<2	High	High	Low	
<2	Moderate	High	Low	
<2	Moderate	High	Low	7
<2	High	High	Low	
<2	Moderate	High	Low	
<2	Moderate	High	Low	6
<2	Moderate	High	Low	
<2	Moderate	High	Moderate	6
<2	Moderate	High	Moderate	
<2	Low	Moderate	Low	2
<2	Low	Moderate	Low	
<2	Moderate	High	Moderate	6
4–12	High	High	Moderate	
4–12	Moderate	High	Moderate	
<2	Low	High	Low	5
<8	Low	High	Low	
<2	Moderate	High	Moderate	7
4–12	High	High	Moderate	
2–8	High	High	Low	8
<2	Low	High	Moderate	6
<2	Moderate	High	Moderate	
<2	Low	High	Low	5
<8	Low	High	Low	
<2	Low	High	Low	5
<4	Low	High	Low	
<8	High	High	Moderate	4
<2	High	High	Low	7
2–16	High	High	Low	
8–16	High	High	Low	
<2	High	High	Low	4L
<2	Moderate	Moderate	Low	
<2	Low	Low	Low	

TABLE 12.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Lefor: LaB, [1] LeC:				
Lefor part	0–12	2.0–6.0	0.16–0.18	6.1–7.3
	12–34	0.6–2.0	0.16–0.18	6.6–8.4
	34–60	0.2–0.6		7.4–8.4
Vebar part	0–36	2.0–6.0	0.15–0.17	6.1–7.8
	36–60			
Manning: MaA, MaB	0–5	2.0–6.0	0.13–0.18	6.1–7.3
	5–33	2.0–6.0	0.12–0.20	6.6–8.4
	33–60	>20	0.02–0.08	7.9–8.4
Moreau: MeA, MeB, MeC	0–6	0.06–0.2	0.15–0.18	7.4–8.4
	6–21	0.06–0.2	0.14–0.17	7.9–8.4
	21–29	0.06–0.2	0.13–0.15	7.9–8.4
	29–60			
Morton:				
MoA, MoB, MoC, [1] MrB, [1] MrC	0–8	0.6–2.0	0.22–0.24	6.1–7.3
	8–24	0.6–2.0	0.16–0.20	6.6–7.8
	24–36	0.6–2.0	0.16–0.20	7.4–8.4
	36–60			
Rhoades part of MrB and MrC	0–3	0.6–2.0	0.15–0.17	6.1–7.3
	3–18	<0.2	0.10–0.12	7.4–9.0
	18–53	<0.2	0.10–0.12	7.9–9.0
	53–60			
[1] MpA, [1] MpB, [1] MpC	0–8	0.6–2.0	0.20–0.22	6.1–7.3
	8–24	0.6–2.0	0.16–0.20	6.6–7.8
	24–36	0.6–2.0	0.16–0.20	7.4–8.4
	36–60			
Mott: MsA, MsB, MtA, MtB	0–46	2.0–6.0	0.13–0.17	5.6–7.8
	46–60	6.0–20	0.03–0.05	7.4–7.8
Parshall: PaB	0–8	2.0–6.0	0.16–0.18	6.6–7.3
	8–60	2.0–6.0	0.12–0.17	6.6–8.4
Patent:				
PeB, PeD, [1] PsD	0–4	0.6–2.0	0.15–0.19	6.6–8.4
	4–60	0.6–2.0	0.14–0.19	7.4–8.4
Sham part of PsD	0–6	0.06–0.2	0.17–0.19	7.4–8.4
	6–60	0.06–0.2	0.14–0.16	8.5–9.0
(Gullied land part of PsD too variable to be estimated.)				
Reeder: ReA, ReB, ReC	0–8	0.6–2.0	0.20–0.23	6.1–7.3
	8–38	0.6–2.0	0.15–0.18	6.6–8.4
	38–60			
Regent:				
RgA, RgB, [1] RhA, [1] RhC	0–36	0.06–0.2	0.17–0.20	6.6–8.4
	36–60			
Rhoades part of RhA	0–3	0.6–2.0	0.15–0.17	6.1–7.3
	3–18	<0.2	0.10–0.12	7.4–9.0
	18–53	<0.2	0.10–0.12	7.9–9.0
	53–60			
Rhoades part of RhC	0–3	0.06–0.2	0.17–0.20	6.6–8.4
	3–18	<0.2	0.10–0.12	7.4–9.0
	18–53	<0.2	0.10–0.12	7.9–9.0
	53–60			
Rhame:				
[1] RkB, [1] RkC, [1] RmC, [1] RmD	0–5	2.0–6.0	0.16–0.18	6.6–7.3
	5–29	2.0–6.0	0.15–0.17	6.6–7.8
	29–35	2.0–6.0	0.14–0.16	7.4–8.4
	35–60			

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Wind erodibility group
		Uncoated steel	Concrete	
Mmhos/cm				
<2	Low	Moderate	Low	3
<2	Moderate	Moderate	Low	
<2		Moderate	Low	
<2	Low	Moderate	Low	3
<2	Low	Moderate	Low	3
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	
<2	High	Moderate	Low	4L
<2	High	Moderate	Low	
<2	High	Moderate	Low	
<2	Low	Moderate	Low	6
<2	Moderate	Moderate	Low	
<2	Moderate	Moderate	Low	
<2	Moderate	High	Low	6
2–16	High	High	Low	
8–16	High	High	Low	
<2	Moderate	Moderate	Low	6
<2	Moderate	Moderate	Low	
<2	Moderate	Moderate	Low	
<2	Low	High	Low	3
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	3
<2	Low	Moderate	Low	
<2	Moderate	Moderate	Low	4L
<2	Moderate	Moderate	Low	
<2	Moderate	Moderate	Low	4L
<2	Moderate	Moderate	Low	
<2	Moderate	High	Moderate	6
<2	Moderate	High	Moderate	
0–8	High	High	Moderate	7
<2	Moderate	High	Low	6
2–16	High	High	Low	
8–16	High	High	Low	
0–8	High	High	Moderate	7
2–16	High	High	Low	
8–16	High	High	Low	
<2	Low	Moderate	Low	3
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	

TABLE 12.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Chinook part of RkB and RkC	0–39	2.0–6.0	0.14–0.18	6.6–7.8
	39–60	6.0–20.0	0.06–0.12	7.4–8.4
Fleak part of RmC and RmD	0–4	2.0–6.0	0.13–0.16	6.6–7.8
	4–19	6.0–20	0.06–0.10	6.6–8.4
	19–60			
Rhoades: [1] RsA, [1] RsC, [1] RxB	0–3	0.6–6.0	0.13–0.15	6.1–7.3
	3–18	<0.2	0.10–0.12	7.4–9.0
	18–53	<0.2	0.10–0.12	7.9–9.0
	53–60			
Belfield part of RsA and RsC	0–12	0.2–2.0	0.20–0.23	6.1–7.3
	12–25	0.2–0.6	0.14–0.18	6.6–7.8
	25–60	0.06–0.6	0.13–0.16	7.9–9.0
Savage: SgA, SgB, [1] ShA	0–6	0.6–2.0	0.14–0.20	6.6–7.8
	6–60	0.2–0.6	0.16–0.20	7.4–8.4
Rhoades part of ShA	0–3	0.6–2.0	0.15–0.17	6.1–7.3
	3–18	<0.2	0.10–0.12	7.4–9.0
	18–53	<0.2	0.10–0.12	7.9–9.0
	53–60			
Searing: SlB, [1] SmB	0–6	0.6–2.0	0.20–0.23	6.1–7.3
	6–23	0.6–2.0	0.17–0.20	6.6–8.4
	23–40			
Ringling part of SmB	0–10	0.6–20	0.12–0.16	6.6–8.4
	10–40			
Sen: SnA, SnB, SnC, [1] SoB, [1] SoC	0–6	0.6–2.0	0.20–0.23	6.6–7.8
	6–34	0.6–2.0	0.16–0.20	6.6–8.4
	34–60			
Golva part of SoB and SoC	0–5	0.6–2.0	0.20–0.23	6.6–7.8
	5–60	0.6–2.0	0.16–0.20	7.4–8.4
[1] SrD:				
Sen part	0–6	0.6–2.0	0.20–0.23	6.6–7.8
	6–34	0.6–2.0	0.16–0.20	6.6–8.4
	34–60			
Amor part	0–32	0.6–2.0	0.20–0.23	6.1–7.3
	32–60			
Sham: [1] SsC	0–6	0.06–0.2	0.17–0.19	7.4–8.4
	6–60	0.06–0.2	0.14–0.16	8.5–9.0
Shambo: StA, StB	0–9	0.6–2.0	0.20–0.22	6.6–7.3
	9–26	0.6–2.0	0.17–0.19	6.6–8.4
	26–41	0.6–2.0	0.17–0.19	7.4–8.4
	41–60	2.0–6.0	0.11–0.13	7.4–8.4
Stady: SyA, SyB, [1] SzC	0–6	0.6–2.0	0.20–0.22	6.6–7.3
	6–18	0.6–2.0	0.17–0.19	6.6–7.8
	18–29	0.6–2.0	0.17–0.19	7.4–8.4
	29–60	>20.0	0.02–0.04	7.4–8.4
Manning part of SzC	0–5	2.0–6.0	0.13–0.18	6.1–7.3
	5–33	2.0–6.0	0.12–0.20	6.6–8.4
	33–60	>20	0.02–0.08	7.9–8.4

properties of soils—Continued

Salinity	Risk of corrosion		Concrete	Wind erodibility group
	Uncoated steel	Uncoated steel		
Mmhos/cm				
<2	Low	High	Low	3
<2	Low	High	Low	
<2	Low	Moderate	Moderate	3
<2	Low	Moderate	Moderate	
<2	Low	Moderate	Low	3
2–16	High	High	Low	
8–16	High	High	Low	
<2	Moderate	High	Low	6
<2	High	High	Moderate	
4–16	High	High	Low	
<2	Moderate	High	Low	7
<8	High	High	Low	
<2	Moderate	High	Low	6
2–16	High	High	Low	
8–16	High	High	Low	
<2	Moderate	High	Moderate	6
<2	Moderate	High	Moderate	
4–8	Low	High	Low	8
<2	Moderate	High	Moderate	6
<2	Moderate	High	Moderate	
<2	Moderate	High	Moderate	6
<2	Moderate	High	Moderate	
<2	Moderate	High	Moderate	6
<2	Moderate	High	Moderate	
<2	Moderate	High	Moderate	6
<2	Moderate	Moderate	Low	4L
<2	Moderate	Moderate	Low	
<2	Moderate	Moderate	Low	6
<2	Moderate	Moderate	Low	
<2	Moderate	Moderate	Low	
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	6
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	3
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	

TABLE 12.—*Physical and chemical*

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction
	In	*In/hr*	*In/in*	*pH*
Tally: TaA, TaB	0–42	2.0–6.0	0.14–0.18	6.6–7.8
	42–60	6.0–20.0	0.06–0.12	7.4–8.4
Telfer: [1] TeB, [1] TeC:				
Telfer part	0–7	6.0–20.0	0.10–0.12	6.6–7.3
	7–60	6.0–20.0	0.06–0.10	6.6–7.8
Lihen part	0–60	6.0–20	0.06–0.16	6.6–7.8
Vebar:				
[1] VfC, [1] VfD, [1] VrB, [1] VrC	0–36	2.0–6.0	0.15–0.17	6.1–7.8
	36–60			
Flasher part of VfC and VfD	0–5	6.0–20.0	0.13–0.17	6.6–7.8
	5–15	6.0–20.0	0.08–0.12	7.4–7.8
	15–60			
Tally part of VrB and VrC	0–42	2.0–6.0	0.14–0.18	6.6–7.8
	42–60	6.0–20.0	0.06–0.12	7.4–8.4
Wabek: WaE	0–4	2.0–6.0	0.20–0.22	6.1–7.3
	4–8	2.0–6.0	0.11–0.15	6.6–7.8
	8–60	>20.0	0.02–0.04	6.6–7.8
Wayden: WyC	0–12	0.06–0.2	0.14–0.19	7.4–8.4
	12–60			
Yetull: YeE	0–11	6.0–20.0	0.06–0.10	6.6–8.4
	11–60	6.0–20.0	0.03–0.07	7.4–8.4
Zeona: ZfC	0–60	6.0–20	0.06–0.10	5.6–8.4

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Wind erodibility groups are made up of soils having the same potential for soil blowing if cultivated. Soils are grouped according to the following distinctions:

1. Mostly dune sands. These soils are single grained and extremely erodible. Vegetation is difficult to establish. The soils are not suitable for cultivation. (None in Slope County.)

2. Loamy sands. These soils have a weak dry clod structure and are very highly erodible. A combination of erosion-control practices is generally needed to control soil blowing.

3. Sandy loams. These soils have a moderately stable dry clod structure and are highly erodible. At least two erosion-control practices generally are needed to control soil blowing.

4. Mostly clays and silty clays. These soils have a dry clod structure that is extremely variable. Slacking and granulation occur when the clay fraction contracts and swells as a result of freezing and thawing or wetting and drying. These moderately to highly erodible soils are generally very resistant to soil blowing after tillage, but they are susceptible to soil blowing in spring before tillage. At least two erosion-control practices generally are required to control soil blowing.

4L. Soils with more than 1 percent lime in the plow layer; mostly loams and silt loams, but some clay loams and silty clay loams. These soils have a variable dry clod structure and are highly erodible because of the granulation effect of lime. The greatest granulation occurs in soils that are about 3 percent lime, and lesser granulation results if the lime content is higher or lower. Further field experience and evaluation are needed to determine the extent of soil blowing; how-

properties of soils—Continued

Salinity	Shrink-swell potential	Risk of corrosion		Wind erodibility group
		Uncoated steel	Concrete	
Mmhos/cm				
<2	Low	High	Low	3
<2	Low	High	Low	
<2	Low	Moderate	Low	2
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	2
<2	Low	Moderate	Low	3
<2	Low	Moderate	Low	3
<2	Low	Moderate	Low	
<2	Low	High	Low	3
<2	Low	High	Low	
<2	Low	Moderate	Low	5
<2	Low	Moderate	Low	
<2	Low	Moderate	Low	
<8	High	High	Moderate	4L
<2	Low	High	Low	2
<8	Low	High	Low	
<2	Very low	Low	Low	8

ever, at least two erosion-control practices are generally needed to control soil blowing.

5. Mostly light loams and silt loams. These soils have a stable, dry clod structure and are moderately erodible. A single erosion-control practice may control soil blowing, but it may be simpler to use two practices, especially if climate is a major factor.

6. Clay loams, heavy loams, and silt loams. These soils have a stable dry clod structure and are slightly erodible. A single erosion-control practice is generally sufficient to control soil blowing.

7. Mostly silty clay loams. These soils have a very stable dry clod structure and are resistant to soil blowing. They generally require no erosion-control practices.

8. Soils not suitable for cultivation because they are wet or stony. Soil blowing is not a problem on these soils.

Soil and Water Features

Table 13 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly im-

TABLE 13.—*Soil and*

[Dashes indicate that the feature is not a concern. See text for descriptions of hydrologic soil groups. See the definitions "flooding"

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Absher: AbA, AbC	D	None		
Amor: AgA, AgB, AgC	B	None		
Arnegard: ArB	B	None		
Badland: [1] BaF (Cabbart part) (Bb and Badland part of BaF not evaluated.)	D	None		
Belfield: BeA, BeB, BfA, BfB, [1] BhA, [1] BhB.	C	None		
Benz:				
BkC, [1] BnC	D	Rare		
Absher part of BnC	D	None		
Borolls:				
Bo	D	None		
[1] BrE:				
Borolls part	B	None		
Orthents part	B	None		
Boxwell: BtB, BtC	C	None		
Brandenburg: [1] BuE:				
Brandenburg part	A	None		
Cabba part	C	None		
Cabba:				
CaE, [1] CbE, [1] CcD, [1] CdD (Badland part of CbE too variable to be evaluated.)	C	None		
Chama part of CcD and CdD	B	None		
Cabbart: CfC, CfD, CfE, [1] CgE (Badland part of CgE too variable to be evaluated.)	D	None		
Chama:				
CmA, CmB, [1] CoB, [1] CoC, [1] CoD, [1] CrC	B	None		
Cabba part of CoB, CoC, and CoD	C	None		
Cabbart part of CrC	D	None		
Chanta: CtA, CtB	B	None		
Cherry: CyC	C	None		
Chinook: CzB	B	None		
Daglum:				
DaB, DaC, [1] DhB	D	None		
Rhoades part of DhB	C	None		
Dimmick: Dk	D	Frequent	Long	Apr-Jun
Ekalaka:				
[1] EdB, [1] EkB, [1] EkC	B	None		
Desart part of EdB	C	None		
Farland: FaA, FaB	B	None		

water features

and "water table" in the Glossary for an explanation of such terms as "rare" and "apparent." The symbol > means more than]

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
>6.0			>40		Low.
>6.0			20–40	Rippable	Moderate.
>6.0			>60		Moderate.
>6.0			10–20	Rippable	Moderate.
>6.0			>40	Rippable	Low.
>6.0			>60		Moderate.
>6.0			>40		Low.
0–1.0	Apparent	Jan-Dec	20–60	Rippable	High.
>6.0			>60		Low.
>6.0			5–20	Rippable	Low.
>6.0			20–40	Rippable	Moderate.
>6.0			10–20	Rippable	Low.
>6.0			10–20	Rippable	Moderate.
>6.0			10–20	Rippable	Moderate.
>6.0			20–40	Rippable	Moderate.
>6.0			10–20	Rippable	Moderate.
>6.0			20–40	Rippable	Moderate.
>6.0			10–20	Rippable	Moderate.
>6.0			10–20	Rippable	Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>40	Rippable	Moderate.
>6.0			>40	Rippable	Low.
1.0–3.0	Apparent	Sep-Jun	>60		Moderate.
>6.0			>40	Rippable	Moderate.
>6.0			>40	Rippable	Moderate.
>6.0			>60		Moderate.

TABLE 13.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Flasher: [1] FbE, [1] FhD, [1] FhE (Badland part of FbE too variable to be evaluated.)	A	None		
Fleak: [1] FkE, [1] FlD, [1] FlE (Badland part of FkE too variable to be evaluated.)	A	None		
Fluvaquentic Haplaquolls: Fu	D	Occasional	Brief	Jan-Dec
Glendive: GlA, GlB	B	Rare		
Golva: GoC	B	None		
Grail: GrA, GrB, GtA, GtB	C	None		
Grassna: GwA, [1] GxB	B	None		
Hanly: [1] HaA	A	Occasional	Brief	Mar-Jun
Harriet: [1] Hc	D	Occasional	Long	Apr-Jun
Havre: HeA	B	Rare		
Heil: [1] Hz:				
Heil part	D	Frequent	Long	Apr-Jun
McKenzie part	D	Common	Long	Mar-Jun
Korchea:				
KcA, [1] Kh	B	Rare to common	Very brief to brief	Mar-Jun
Havre part of Kh	B	Rare		
Kremlin: KrB, KrC	B	None		
Lawther:				
LaA, LaB, [1] Lc	D	None		
Rhoades part of Lc	C	None		
Lawther variant: LdA, LdC	D	None		
Lefor: [1] LeB, [1] LeC:				
Lefor part	B	None		
Vebar part	B	None		
Manning: MaA, MaB	B	None		
Moreau: MeA, MeB, MeC	D	None		
Morton:				
MoA, MoB, MoC, [1] MpA, [1] MpB, [1] MpC, [1] MrB, [1] MrC.	B	None		
Rhoades part of MrB and MrC	C	None		
Mott: MsA, MsB, MtA, MtB	A	Occasional	Brief	Apr-Jul
Parshall: PaB	B	None		
Patent:				
PeB, PeD, [1] PsD	C	None		
Sham part of PsD (Gullied land part of PsD too variable to be evaluated.)	D	None		
Reeder: ReA, ReB, ReC	B	None		
Regent:				
RgA, RgB, [1] RhA, [1] RhC	C	None		
Rhoades part of RhA and RhC	C	None		

water features—Continued

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
>6.0			7–20	Rippable	Low.
>6.0			10–20	Rippable	Low.
0–1.0	Apparent	Jan-Dec	>60		High.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Low.
3.0–5.0	Apparent	Sep-Jun	>60		High.
>3.0	Apparent	Mar-Sep	>60		Moderate.
3.0–5.0	Apparent	Sep-Jun	>60		Moderate.
>6.0			>60		Low.
>6.0			>60		Moderate.
>3.0	Apparent	Mar-Sep	>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Low.
>6.0			>40	Rippable	Low.
>6.0			>60		Low.
>6.0			20–40	Rippable	Moderate.
>6.0			20–40	Rippable	Low.
>6.0			>60		Low.
>6.0			20–40	Rippable	Low.
>6.0			20–40	Rippable	Moderate.
>6.0			>40	Rippable	Low.
>6.0			>60		Low.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			20–40	Rippable	Moderate.
>6.0			20–40	Rippable	Low.
>6.0			>40	Rippable	Low.

TABLE 13.—*Soil and*

Soil name and map symbol	Hydrologic group	Flooding		
		Frequency	Duration	Months
Rhame:				
[1] RkB, [1] RkC, [1] RmC, [1] RmD	B	None		
Chinook part of RkB and RkC	B	None		
Fleak part of RmC and RmD	A	None		
Rhoades: [1] RsA, [1] RsC, [1] RxB	C	None		
Savage:				
SgA, SgB, [1] ShA	C	None		
Rhoades part of ShA	C	None		
Searing:				
SlB, [1] SmB	B	None		
Ringling part of SmB	A	None		
Sen:				
SnA, SnB, SnC, [1] SoB, [1] SoC, [1] SrD	B	None		
Golva part of SoB and SoC	B	None		
Sham: [1] SsC	D	None		
Shambo: StA, StB		None		
Stady:				
SyA, SyB, [1] SzC	B	None		
Manning part of SzC	B	None		
Tally: TaA, TaB	B	None		
Telfer: [1] TeB, [1] TeC:				
Telfer part	A	None		
Lihen part	A	None		
Vebar:				
[1] VfC, [1] VfD, [1] VrB, [1] VrC	B	None		
Flasher part of VfC and VfD	A	None		
Tally part of VrB and VrC	B	None		
Wabek: WaE	B	None		
Wayden: WyC	D	None		
Yetull: YeE	A	None		
Zeona: ZfC	A	None		

[1] This mapping unit is made up of two or more dominant kinds of soil. See the description of the mapping unit for the composition and behavior characteristics of the mapping unit.

pervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils.

water features—Continued

High water table			Bedrock		Potential frost action
Depth	Kind	Months	Depth	Hardness	
Ft			*In*		
>6.0			20–40	Rippable	Moderate.
>6.0			>60		Moderate.
>6.0			10–20	Rippable	Low.
>6.0			>40	Rippable	Low.
>6.0			>60		Moderate.
>6.0			>40	Rippable	Low.
>6.0			20–40	Rippable	Moderate.
>6.0			10–20	Rippable	Low.
>6.0			20–40	Rippable	Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Moderate.
>6.0			>60		Low.
>6.0			>60		Moderate.
>6.0			>60		Low.
>6.0			>60		Moderate.
>6.0			20–40	Rippable	Low.
>6.0			7–20	Rippable	Low.
>6.0			>60		Moderate.
>6.0			>60		Low.
>6.0			10–20	Rippable	Low.
>6.0			>60		Low.
>6.0			>60		Low.

Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 13 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of

damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Mechanical and Chemical Analysis

Unpublished data that give detailed mechanical and chemical analyses of the following soils in Slope County are available from the Soil Conservation Service and the North Dakota Agricultural Experiment Station: Cabba silt loam (SU70ND–44–4), Chama silt loam (SU70ND–44–3), Grassna silt loam (SU70ND–44–1), Sen silt loam (SU70ND–44–2), Golva silt loam (SU70ND–44–5), Mott sandy loam (SU72ND–44–1), Study loam (SU72ND–44–3), Lawther clay, sandy subsoil variant (SU72ND–44–2), Moreau silty clay (S64ND–44–1 and S64ND–44–2), and a silt loam soil (SU70ND–44–6) that is similar to Chama silt loam but has a surface layer that is too light in color to be considered a mollic epipedon.

The data are useful in classifying soils and in developing concepts of soil genesis. They are also useful in estimating available water capacity, wind erodibility, fertility, tilth, and other soil properties that affect management.

Formation and Classification of Soils

In this section the factors of soil formation are discussed and related to the soils in Slope County. In addition, the system of soil classification currently used is explained, and the soils of the county are placed in categories of that system.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials deposited or accumulated by geologic agents. Soil characteristics are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, or lay of the land, and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed, and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil that has a developed profile. It may be much or little, but some time is always required for differentiation of soil horizons. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

Parent material

A majority of the soils in Slope County developed in sedimentary material deposited millions of years ago when this area was covered by oceans or inland seas. Members of the White River, Fort Union, Hell Creek, and Fox Hill Formations of this period are in Slope County.

The White River Formation is the youngest formation in the county. It is on the summits and upper sides of buttes at the highest elevations. Most of this formaion has been removed by geologic erosion.

The Fort Union Formation is the next oldest and most extensive formation. It consists of stratified layers of sandstone, shale, siltstone, and lignite coalbeds. Major soils that developed on beds of siltstone of this formation are the Morton, Amor, Chama, and Cabba soils. Major soils that developed on sandstone strata are the Vebar, Flasher, and Tally soils.

The Hell Creek Formation lies below the Fort Union Formation. It consists of stratified layers of sandstone, shale, and bentonite. Sandstone and sandy shale are the dominant rocks of this formation.

The Fox Hill Formation is the oldest formation in the survey area. It consists mainly of stratified sandstone.

Alluvium of the Holocene Epoch covers flood plains of the Little Missouri River and other major rivers and streams. Organic-matter content of these soils is low, and soil horizons are poorly developed.

The texture of parent material is important, because it determines the texture of the soil. For example, Yetull soils formed in sandy, wind-reworked parent material; they are too sandy for cultivation. Soils that formed in siltstone are silty; these soils are easily tilled, and plant roots and water penetrate easily.

Climate

Slope County has warm summers and cold winters. The average precipitation is slightly more than 15 inches; three-fourths of the annual total falls during the growing season.

Rainfall and temperature directly affect the soils through weathering of parent material; leaching and redistribution of carbonates and clay particles in the soil profile, for example, in Morton and Farland soils; and accumulating organic matter, for example, in the Grail and Grassna soils. Rainfall and temperatures are also directly responsible for the kinds of plants and animals that contribute to soil development.

Weathering proceeds more slowly in Slope County than in the warmer, more humid parts of the country. In winter when the ground is frozen, leaching does not occur. In summer, rainfall peaks when evaporation and

transpiration approach their maximum. Rapid evaporation and the maximum growth of vegetation at this time tend to decrease soil leaching, because they reduce the amount of water moving downward through the soil. The older soils on uplands are leached of carbonates to a depth of about 12 to 24 inches.

The boundary between the aridic and ustic soil moisture zones crosses Slope County (fig. 12). Soil moisture in the ustic zone is limited, but it is generally present in sufficient amounts when conditions are suitable for plant growth. Soil moisture in the aridic zone is more limited than in the ustic zone. The differences in soil profile development and in soil use and management in Slope County because of the effects of these moisture zones are small. The same soils occur on both sides of the boundary.

Relief

Relief, or lay of the land, affects soil formation in several ways. Soils are poorly drained in areas where water stands in basins during part or all of the year. Such soils have many properties different from other soils, including arrangement of the soil horizons and mottling in the subsoil. Poorly drained soils in Slope County include Dimmick, Heil, and McKenzie soils.

The soils in the county are mostly nearly level to strongly sloping. On excessively drained ridgetops, the soils are shallow, organic-matter content is low, and lime is near the surface. Examples are Cabba, Cabbart, Flasher, and Fleak soils. Surface runoff is probably the most limiting factor in the formation of the excessively drained, strongly sloping and steep soils. These soils are dry because much of the precipitation runs off and does not penetrate the soil. Consequently, the plant cover is sparse, the soils continue to erode, and soil development is restricted.

Plant and animal life

The native vegetation in Slope County, consisting mainly of short and mid grasses, has influenced soil development mainly through the large amount of decaying organic matter that is incorporated into the soil. In addition, roots penetrate the soil and bring up plant nutrients, which are left near the surface as the plants decay.

Bacteria and other minute organisms have an important role in soil formation. They break down plant and animal matter to form humus. Some forms of bacteria remove nitrogen from the atmosphere and, in association with legumes, convert it into a form that can be used by plants. Earthworms, some insects, rodents, and burrowing animals also affect soil development, mainly through soil mixing.

Time

Time is necessary for the factors of soil formation to act on parent material. The length of time for a particular soil to develop depends on parent material, relief, climate, and plant and animal life.

The soils in the survey area range from mature soils

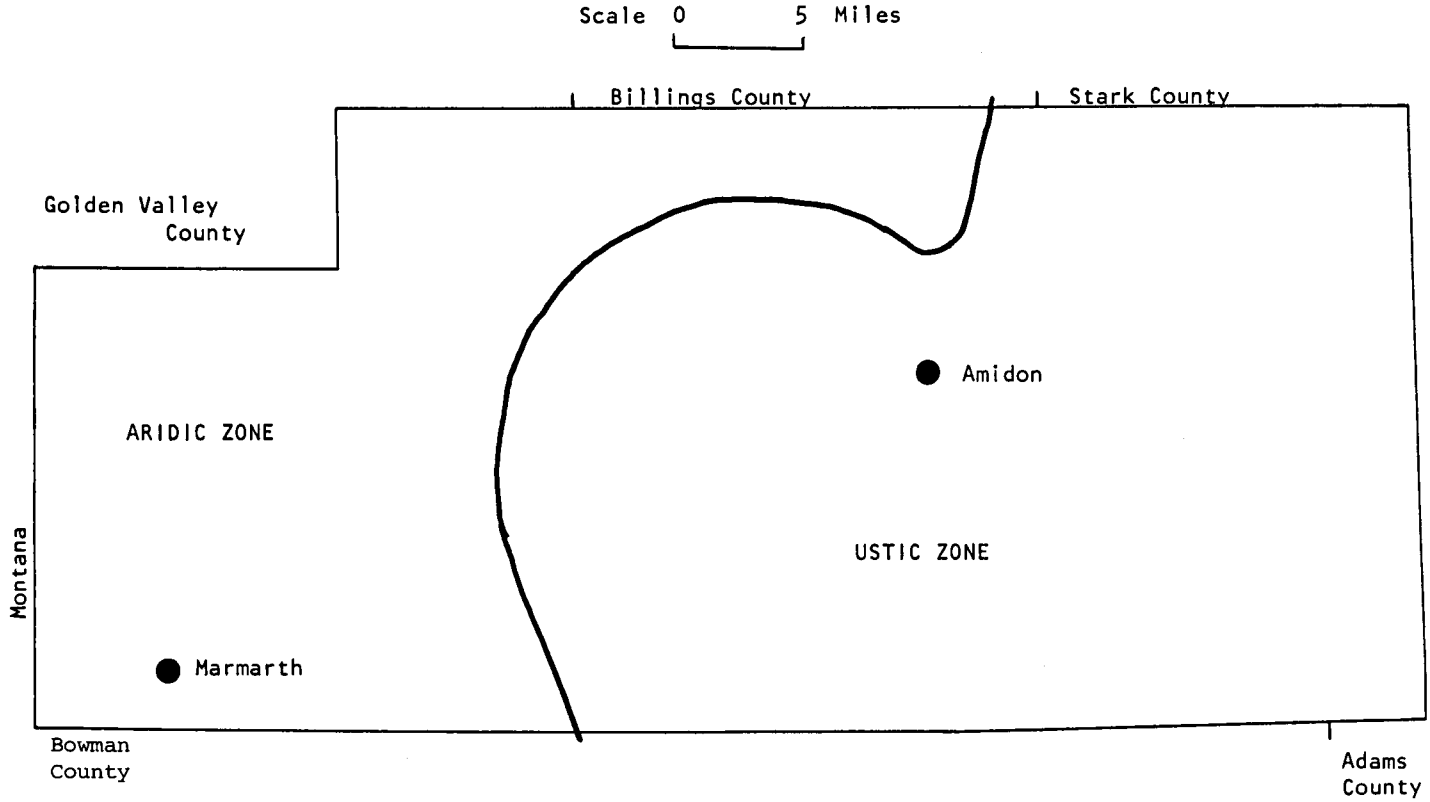

Figure 12.—**Soil moisture zones in Slope County.**

that have well developed profile characteristics to young soils that have little or no horizon differentiation or profile development. The well drained soils, for example, Morton soils, are among the most mature soils in the survey area.

The effect of time is often modified by human activity. For example, tillage can cause erosion, and irrigation affects drainage and the accumulation of salts.

Most differences in soil profile development result from the combined effects of the other soil-forming factors rather than from the effects of time.

Classification

The system of classification used by the National Cooperative Soil Survey (*5*) has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 14, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol.* An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of suborder indicates the order. An example is Orthent (*Ort,* meaning true, plus *ent,* from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Ustorthents (*Ust,* meaning dry climate or ustic moisture regime, plus *orthent,* the suborder of Entisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Ustorthents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is loamy, mixed (calcareous), frigid, shallow, Typic Ustorthents, which is the complete classification for soils in the Cabbart series.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

General Nature of the County

Slope County was organized in 1915. Many of the early settlers emigrated from Norway, and most settled in the eastern Dakotas or in Minnesota before moving to Slope County. Others emigrated from Germany and the Ukraine. Many from Texas and the Southwest came North on cattle drives and then settled in Slope County.

The population in 1920 was 4,940. It peaked in the 1920's and then gradually declined. In 1970, the population was 1,484, including 247 at Marmarth and 54 at Amidon, the county seat. Nearly 90 percent of the population lives on farms.

The U.S. Government owns about 132,401 acres or 16.8 percent of the county's land area. Most of the Government-owned land is administered by the Forest Service. Most of this land was purchased during the 1930's in an effort by the Federal Government to resettle displaced farmers, purchase submarginal land, and reestablish grass on the land. This land is leased to farmers and ranchers.

The topography ranges from nearly level plains to very steep buttes and valleys cut by streams. White Butte, the highest point in North Dakota, has an elevation of 3,506 feet. The lowest elevation in the county is about 2,400 feet.

The eastern two-thirds of the county is gently sloping. Several buttes stand several hundred feet above the plain. In the western third of the county, Badland is on both sides of the Little Missouri River and its tributaries.

Slope County has three main watersheds: the Little Missouri River, the Cannonball River, and Cedar Creek. These streams have enough water in most years for irrigation or waterspreading.

In 1975, no aquifers had been discovered in the survey area, but a ground water study had begun. Most of the ground water is high in content of soluble salts.

There are some oil wells in the county. Uranium was mined for a time in the north-central part. Large amounts of lignite coal underlie some parts of the county. To date, there are no producing mines. Gravel

TABLE 14.—*Classification of the soils*

Soil name	Family or higher taxonomic class
Absher	Fine, montmorillonitic Borollic Natrargids.
Amor	Fine-loamy, mixed Typic Haploborolls.
Arnegard	Fine-loamy, mixed Pachic Haploborolls.
Belfield	Fine, montmorillonitic Glossic Natriborolls.
Benz	Fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents.
Borolls	Sandy and loamy, mixed Haploborolls, Argiborolls, and Natriborolls.
Boxwell	Fine-loamy, mixed Aridic Haploborolls.
Brandenburg	Loamy-skeletal, mixed (calcareous), frigid Lithic Ustorthents.
Cabba	Loamy, mixed (calcareous), frigid, shallow Typic Ustorthents.
Cabbart	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents.
Chama	Fine-silty mixed Typic Haploborolls.
Chanta	Fine-loamy over sandy or sandy-skeletal, mixed Aridic Haploborolls.
Cherry	Fine-silty, mixed, frigid Typic Ustochrepts.
Chinook	Coarse-loamy, mixed Aridic Haploborolls.
Daglum	Fine, montmorillonitic Typic Natriborolls.
Desart	Coarse-loamy, mixed Typic Natriborolls.
Dimmick	Fine, montmorillonitic, frigid Vertic Haplaquolls.
Ekalaka	Coarse-loamy, mixed Typic Natriborolls.
Farland	Fine-silty, mixed Typic Argiborolls.
Flasher	Mixed, frigid, shallow Typic Ustipsamments.
Fleak	Mixed, frigid, shallow Typic Torripsamments.
Fluvaquentic Haplaquolls	Loamy, mixed (calcareous), frigid Fluvaquentic Haplaquolls.
Glendive	Coarse-loamy, mixed (calcareous), frigid Ustic Torrifluvents.
Golva	Fine-silty, mixed Typic Haploborolls.
Grail	Fine, montmorrillonitic Pachic Argiborolls.
Grassna	Fine-silty, mixed Pachic Haploborolls.
Hanly	Sandy, mixed, frigid Ustic Torrifluvents.
Harriet	Fine, mixed, frigid Typic Natraquolls.
Havre	Fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents.
Heil	Fine, montmorillonitic, frigid Typic Natraquolls.
Korchea	Fine-loamy, mixed (calcareous), frigid Mollic Ustifluvents.
Kremlin	Fine-loamy, mixed Aridic Haploborolls.
Lawther	Fine, montmorrillonitic Vertic Haploborolls.
Lawther variant	Fine, mixed, frigid Vertic Ustorthents.
Lefor	Fine-loamy, mixed Typic Argiborolls.
Lihen	Sandy, mixed Entic Haploborolls.
Manning	Coarse-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls.
McKenzie	Fine, montmorillonitic (calcareous), frigid Typic Haplaquepts.
Moreau	Fine, montmorillonitic Typic Haploborolls.
Morton	Fine-silty, mixed Typic Argiborolls.
Mott	Coarse-loamy, mixed Typic Haploborolls.
Orthents	Loamy, mixed, frigid, shallow, Ustorthents.
Parshall	Coarse-loamy, mixed Pachic Haploborolls.
Patent	Fine-loamy, mixed (calcareous), frigid Ustic Torriorthents.
Reeder	Fine-loamy, mixed Typic Argiborolls.
Regent	Fine, montmorillonitic Typic Argiborolls.
Rhame	Coarse-loamy, mixed Aridic Haploborolls.
Rhoades	Fine, montmorillonitic Leptic Natriborolls.
Ringling	Fragmental, mixed Typic Haploborolls.
Savage	Fine, montmorillonitic Typic Argiborolls.
Searing	Fine-loamy, mixed Typic Haploborolls.
Sen	Fine-silty, mixed Typic Haploborolls.
Sham	Coarse-loamy, mixed (calcareous), frigid Ustic Torriorthents.
Shambo	Fine-loamy, mixed Typic Haploborolls.
Stady	Fine-loamy over sandy or sandy-skeletal, mixed Typic Haploborolls.
Tally	Coarse-loamy, mixed Typic Haploborolls.
Telfer	Sandy, mixed Entic Haploborolls.
Vebar	Coarse-loamy, mixed Typic Haploborolls.
Wabek	Sandy-skeletal, mixed Entic Haploborolls.
Wayden	Clayey, montmorillonitic (calcareous), frigid, shallow Typic Ustorthents.
Yetull	Mixed, frigid Ustic Torripsamments.
Zeona	Mixed, frigid Ustic Torripsamments.

for roads is available in some areas, especially in the Flasher-Badland-Cabba association. Scoria, or porcellanite, is also used for surfacing roads. It is most common in the Absher-Belfield-Rhoades association, but it is found in nearly all areas of the county.

U.S. Highway 85 extends north and south through the east-central part of the survey area. North Dakota Highways 21 and 67 are primary roads in the eastern part of the county. U.S. Highway 12 crosses the extreme southwestern part of the county through Marmarth. Improved gravel roads provide access to most farms and ranches. A main line of the Chicago, Milwaukee, St. Paul, and Pacific Railroad parallels U.S. Highway 12 in the southwestern part of the county.

Climate [6]

Slope County has a typical continental climate in which annual and daily temperatures vary widely. There is usually a rapid progression of air mass systems through the county: cold and dry air masses from the polar regions cross the county in winter, and warm and relatively moist air masses from the Gulf of Mexico account for the variable precipitation. Length of daylight in Slope County ranges from less than 9 hours daily in December to more than 16 hours daily in June.

Air temperature in Slope County varies widely because of the northerly location. The mean annual temperature is 42.5° F and, as shown in table 15, the average daily temperature ranges from 12.7° in January to 70.1° in July. The average daily minimum temperature is 1.45° in January, and the average daily maximum temperature is 84.6° in July.

The minimum daily temperature in Slope County is above freezing on only 125 days of the year. Typically, the first freeze occurs on about September 16. The average date for the last freeze in spring is about May 20.

Determinations of the length of the frost-free period, a reasonable approximation of the growing season, are based on temperatures in exposed shelters 5 feet above ground level. It is not unusual for the air temperature closer to the ground to be 3 to 7 degrees lower than that measured inside an instrument shelter, especially on clear and calm nights and early in the morning when radiation loss from the ground and from overlying air layers is unimpeded by clouds.

In most years, small grain is planted in Slope County when the mean air temperature is about 40° F. The probability of a mean temperature of 40° is shown in table 16.

The occurrence of freezing temperatures is a prime consideration in scheduling fieldwork. The probability of frost (32° F and below) in Slope County in spring and fall is also in table 16. There is about a 25 to 30 percent chance of frost as late as the end of May, and there is more than a 50 percent probability of morning frost as early as mid-September.

Crop yields are adversely affected by temperatures in excess of 90°. The maximum daily temperature exceeds 90° on an average of 24 days a year in Slope County. During the hottest period of the year, which extends from the last week in July through mid-August, there is an 85 to 90 percent chance that the maximum temperature will be more than 90° on one day of the week.

If subzero temperatures occur with high winds, livestock must receive special protection and outdoor activity is greatly curtailed. The probability of subzero temperatures occurring for 5 consecutive days or longer in Slope County is shown in table 16.

Extended periods of above-freezing temperatures in winter affect the planning and completing of outdoor work in construction and in other engineering activities. This data and data on snow cover are significant for forecasting floods and for the soil thawing and freezing problems associated with frost heaving.

The average annual precipitation in Slope County is 15.5 inches. This low amount places the county in a subhumid climatic classification. Over the last 70 years, however, the Marmarth Station recorded an average annual precipitation of approximately 20 inches for 6 years and a precipitation of only 5 inches for 1 year, 1935. Despite the low annual precipitation, industry and small grain crops benefit from having more than 80 percent of the annual precipitation fall in April through September.

Weekly precipitation in Slope County gradually increases from about one-tenth of an inch a week at the beginning of spring to a little less than an inch in the first week in June. It then gradually decreases to less than one-tenth of an inch early in October.

[6] J. M. RAMIREZ, associate professor of soils (climatology), North Dakota State University, assisted in preparing this section.

TABLE 15.—*Temperature, precipitation, and cloudiness*

Month	Average temperature			Average precipitation	Snowfall	Average number of days that are—		
	Maximum daily	Minimum daily	Daily			Clear	Partly cloudy	Cloudy
	°F	°F	°F	In	In			
January	24.0	1.45	12.7	.46	5.19	6	9	16
February	29.8	7.0	18.4	.42	4.02	5	8	15
March	38.0	15.8	26.9	.64	5.08	6	8	17
April	54.4	29.1	41.8	1.41	3.28	6	9	15
May	66.8	40.4	53.6	2.33	.43	6	11	14
June	75.4	49.9	62.7	3.64	0	7	10	13
July	84.6	55.5	70.1	2.28	0	12	12	7
August	84.2	53.4	68.7	1.67	0	13	10	8
September	72.1	42.6	57.3	1.22	.13	10	8	12
October	60.3	31.9	46.1	.66	1.80	10	8	13
November	41.8	19.0	30.4	.47	3.50	6	8	10
December	30.8	8.8	19.7	.37	3.74	6	7	18
Year	55.3	29.7	42.5	15.57	25.37	93	108	164

TABLE 16.—*Probability of selected temperatures, by weeks*

Temperature	Week	Probability
		Pct
Average of 40° F or higher.	March 22–28	20
	March 29–April 4	30
	April 5–11	40
	April 12–18	70
	April 19–25	85–90
	April 26–May 2	80–85
Minimum of 32° F or lower, in spring.	May 3–9	70–80
	May 17–23	40
	May 31–June 6	10–15
Minimum of 32° F or lower, in fall.	August 30–September 5	10–15
	September 13–19	40–50
	September 27–October 3	80
Daily minimum below 0° F on 5 or more consecutive days.	December 13–19	20–25
	December 27–January 2	20–25
	January 10–16	30–35
	January 24–30	40
	February 7–13	20
	February 21–29	15–20
Daily maximum of 32° F or higher on 5 or more consecutive days.	October 25–31	90+
	November 8–14	70
	December 6–12	40
	January 3–9	20–30
	January 31–February 6	30
	March 1–7	40–45
	March 29–April 4	85–90

The probability of at least one-half inch of rain falling per week in March, April, and May ranges from less than 5 percent to about 25 percent. About the same amount is lost through evaporation each week during spring. In summer, when the moisture deficit is more critical, about one-fourth inch of water per day may be lost through evaporation on an open surface, although loss by crops is usually less.

Less than one-fourth of the annual precipitation in Slope County falls as snow. At least 6 inches of snow are on the ground on about 20 days of the year. In an average year, the first inch of accumulation falls in the last week of December, and the last inch falls as late as mid-March.

Westerly and east-southeasterly winds prevail from November through early in spring. Northwest and southeast winds prevail from May through fall. Windspeed is mainly 8 to 15 miles per hour.

Most summer precipitation in Slope County is associated with severe thunderstorms. Thunderstorms occur on about 36 days each year. Thunderstorm activity peaks in July, when an average of 10 days have thunderstorms.

Hail falls in the county mainly in June, July, and August. In a 20-year period, hail damage has been reported 50 times.

Tornadoes also occur in Slope County.

Relative humidity and dewpoint temperature are convenient indicators of moisture in the air. Relative humidity is highest in mid-winter, ranging from 65 to 75 percent throughout the day. Much lower humidity occurs in the afternoon during summer and late in fall. Dewpoint temperature ranges from just above 5° in winter to 55° in summer, following the air temperature trends very closely.

The interaction of the two most important elements of climate—precipitation and temperature—causes droughts and wet spells. Long-term records of Slope County show that 10 droughts and 11 wet spells occurred in 1930 through 1970. In more than half of this time, at least some restriction of crop growth occurred during the growing season. The long, severe droughts in the 1930's and wet spells in the 1940's were followed by deficits of surface moisture alternating with moderate surpluses. Wet spells in the late 1960's were markedly more serious than in earlier years.

Farming

Since the early 1930's, the number of farms in the county has decreased and the size has increased. In 1950, there were 456 farms, and the average size was 1,340 acres. In 1969, there were 324 farms, and the average size was 2,240 acres. Of these, 139 farms were operated by full owners, 144 by part owners, and 41 by tenants.

About 93 percent of the county is farmland. About 38 percent is used for cultivated crops. The farms are mainly diversified, but some raise only small grain or only livestock. A few are dairy farms.

Wheat is the principal crop. Oats, barley, rye, corn, and alfalfa are also grown. In 1969, wheat was harvested on 82,868 acres; oats, on 15,883 acres; barley, on 8,504 acres; and rye, on 4,387 acres. Alfalfa and alfalfa-grass mixtures were cut on 16,107 acres. Corn was grown on 2,576 acres; most of the corn was cut for silage.

Livestock is an important part of the economy. In 1969, 230 farms raised 25,979 cattle and calves, 50 farms raised 1,656 hogs, and 33 farms raised 4,502 sheep. Most of the livestock are sold as feeder animals or as butcher cows and bulls. The trend has been toward fewer livestock.

Most of the small grain is raised in the eastern two-thirds of the county. The western third is used mainly for cattle grazing.

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Glossary

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial fan. A fan-shaped deposit of sand, gravel, or finer textured material dropped by streams in places where gradient abruptly decreases.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Buffer strips. Narrow strips of row crops, including flax, corn, and tame mustard that are seeded late in the growing season on summer fallow. The strips help to control soil blowing and hold snow on fields in winter. Tall wheatgrass can be used as a permanent buffer strip.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards. A cover crop commonly is planted in late summer to protect fallow fields from soil blowing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation put may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpets" and "climatic moors."

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not

probable; rare that it is unlikely but possible under unusual weather conditions; occasional that it occurs on an average of once or less in 2 years; and frequent that it occurs on an average of more than once in 2 years. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, and long if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Organic matter. A general term for plant and animal material in or on the soil in all stages of decomposition. Readily decomposed organic matter is often distinguished from the more stable forms that are past the stage of rapid decomposition.

Overgrazing. Grazing so heavily that future production of forage is impaired and plants or soil, or both, deteriorate.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Porcellanite. Also called scoria. Red baked shale or clinker beds formed by burning of underground coal veins.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consisting, and mineralogical and chemical composition.

Shrink-swell. The shinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons

are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface layer. The soil material above the subsoil. It includes the A horizon and part of the B horizon and has no depth limit.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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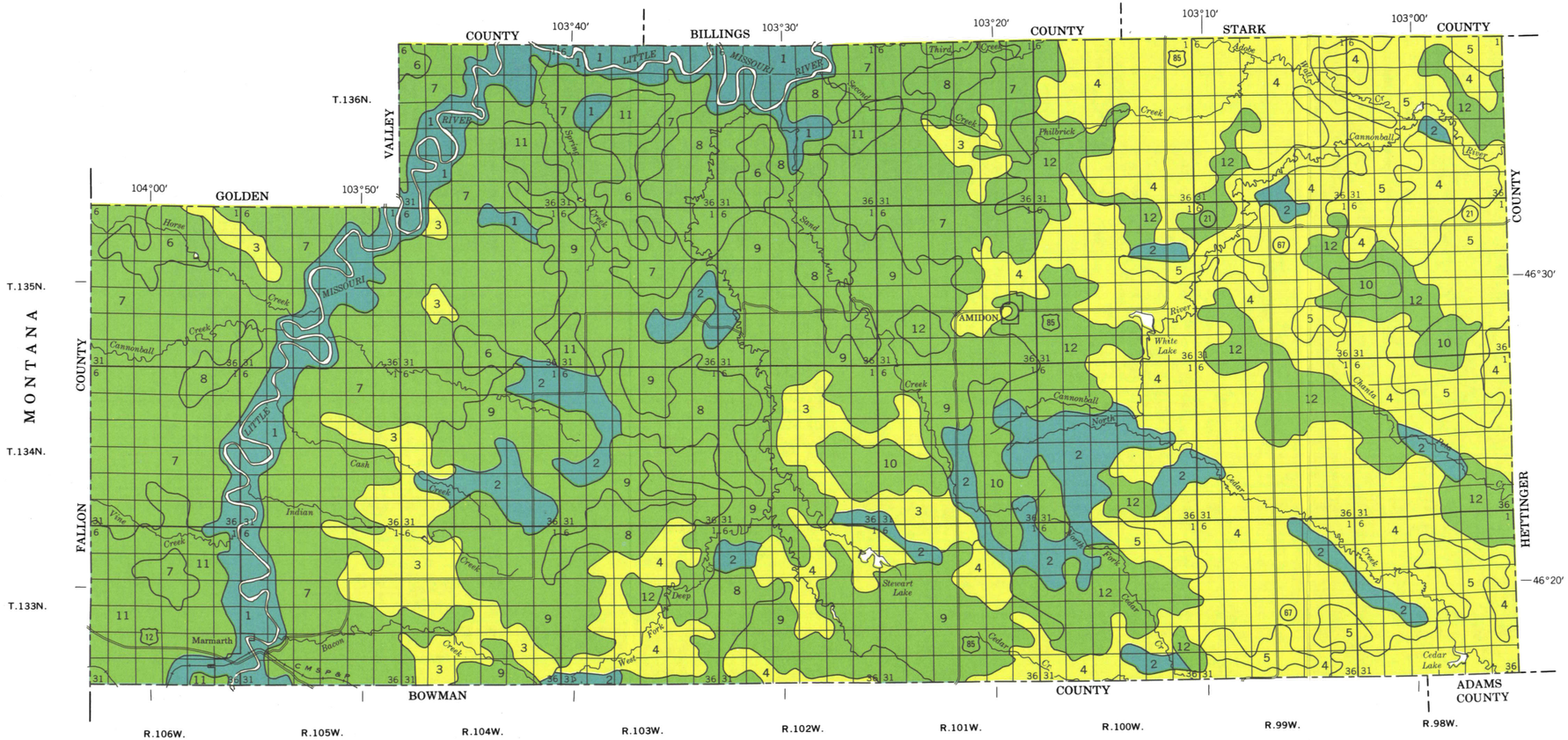

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

SLOPE COUNTY, NORTH DAKOTA

Scale 1:253,440
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS *

NEARLY LEVEL TO MODERATELY SLOPING SOILS ON TERRACES, ALLUVIAL FANS, AND BOTTOM LAND

1 Hanly-Chanta-Glendive association: Moderately well drained to somewhat excessively drained, deep soils that are moderately coarse, coarse, and medium textured

2 Stady-Shambo-Mott association: Well drained, deep soils that are medium textured and moderately coarse textured

NEARLY LEVEL TO STRONGLY SLOPING SOILS ON UPLANDS

3 Absher-Belfield-Rhoades association: Moderately well drained and well drained, deep soils that are medium, moderately fine, and fine textured

4 Belfield-Rhoades-Moreau association: Moderately well drained and well drained, deep and moderately deep soils that are medium, moderately fine, and fine textured

5 Morton-Regent-Sen association: Well drained, moderately deep soils that are medium textured and moderately fine textured

NEARLY LEVEL TO VERY STEEP SOILS ON UPLANDS

6 Chama-Cabbart-Sen association: Well drained to excessively drained, moderately deep and shallow soils that are medium textured

7 Badland-Cabbart association: Excessively drained, shallow soils that are medium textured and Badland

8 Brandenburg-Cabba-Cabbart association: Well drained to excessively drained, shallow soils that are medium textured

9 Chama-Cabba-Sen association: Well drained and excessively drained, moderately deep and shallow soils that are medium textured

10 Flasher-Badland-Cabba association: Somewhat excessively drained and excessively drained, shallow soils that are moderately coarse, coarse, and medium textured and Badland

11 Fleak-Rhame-Zeona association: Well drained and excessively drained, deep, moderately deep, and shallow soils that are coarse textured and moderately coarse textured

12 Vebar-Tally-Flasher association: Well drained and somewhat excessively drained, deep, moderately deep, and shallow soils that are coarse textured and moderately coarse textured

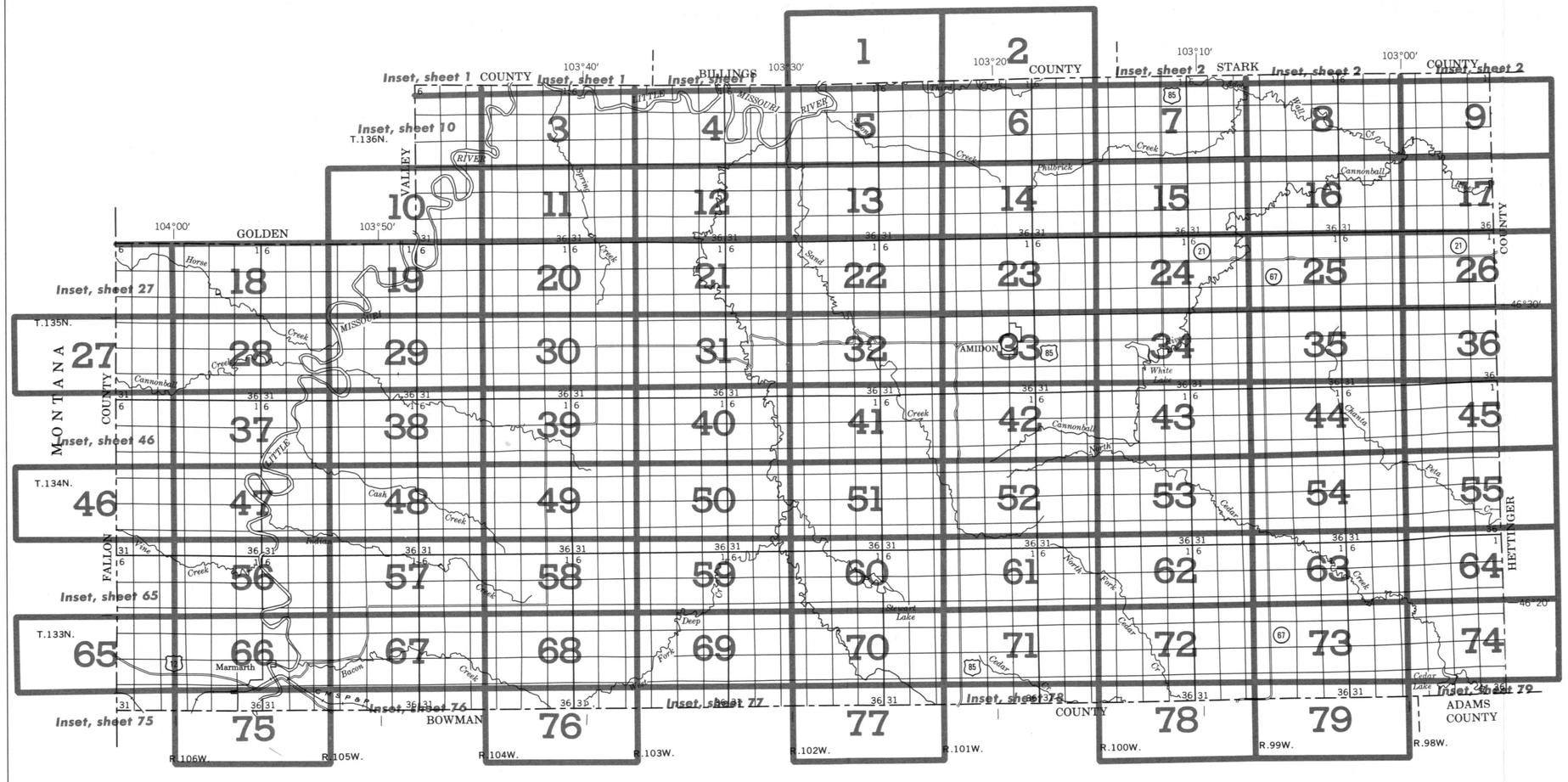
* Terms describing texture refer to the surface layer of the major soils in each association

Compiled 1977

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

SLOPE COUNTY, NORTH DAKOTA

Scale 1:253,440

1 0 1 2 3 4 Miles

N

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

The first capital letter is the initial one of the soil name. The lower case letter that follows separates mapping units having names that begin with the same letter except that it does not separate slope phases. A second capital letter A, B, C, D, E or F shows the slope. Symbols without a slope letter are for soils that are nearly level or a miscellaneous land type.

SYMBOL	NAME
AbA	Absher loam, 1 to 3 percent slopes
AbC	Absher loam, 3 to 9 percent slopes
AgA	Amor loam, 1 to 3 percent slopes
AgB	Amor loam, 3 to 6 percent slopes
AgC	Amor loam, 6 to 9 percent slopes
ArB	Arnegard loam, 3 to 6 percent slopes
BaF	Badland-Cabbart complex, 9 to 50 percent slopes
Bb	Badland
BeA	Belfield silt loam, 1 to 3 percent slopes
BeB	Belfield silt loam, 3 to 6 percent slopes
BfA	Belfield silty clay loam, 1 to 3 percent slopes
BfB	Belfield silty clay loam, 3 to 6 percent slopes
BhA	Belfield-Rhoades silty clay loams, 1 to 3 percent slopes
BhB	Belfield-Rhoades silty clay loams, 3 to 6 percent slopes
BkC	Benz silt loam, 1 to 9 percent slopes
BnC	Benz and Absher clay loams, 1 to 9 percent slopes
Bo	Borolls, saline
BrE	Borolls and Orthents, stony, 15 to 45 percent slopes
BtB	Boxwell loam, 3 to 6 percent slopes
BtC	Boxwell loam, 6 to 9 percent slopes
BuE	Brandenburg-Cabba complex, 6 to 40 percent slopes
CaE	Cabba loam, 15 to 40 percent slopes
CbE	Cabba-Badland complex, 9 to 40 percent slopes
CcD	Cabba-Chama complex, 9 to 15 percent slopes
CdD	Cabba-Chama stony loams, 3 to 20 percent slopes
CfC	Cabbart silt loam, 3 to 9 percent slopes
CfD	Cabbart silt loam, 9 to 15 percent slopes
CfE	Cabbart silt loam, 15 to 40 percent slopes
CgE	Cabbart-Badland complex, 9 to 40 percent slopes
CmA	Chama silt loam, 1 to 3 percent slopes
CmB	Chama silt loam, 3 to 6 percent slopes
CoB	Chama-Cabba silt loams, 3 to 6 percent slopes
CoC	Chama-Cabba silt loams, 6 to 9 percent slopes
CoD	Chama-Cabba silt loams, 9 to 15 percent slopes
CrC	Chama-Cabbart silt loams, 6 to 9 percent slopes
CtA	Chanta loam, 1 to 3 percent slopes
CtB	Chanta loam, 3 to 6 percent slopes
CyC	Cherry silty clay loam, 3 to 9 percent slopes
CzB	Chinook fine sandy loam, 1 to 6 percent slopes
DaB	Daglum fine sandy loam, 1 to 6 percent slopes
DaC	Daglum fine sandy loam, 6 to 9 percent slopes
DhB	Daglum-Rhoades silty clay loams, 1 to 6 percent slopes
Dk	Dimmick silty clay
EdB	Ekalaka-Desart fine sandy loams, 1 to 6 percent slopes
EkB	Ekalaka soils, 1 to 6 percent slopes
EkC	Ekalaka soils, 6 to 9 percent slopes
FaA	Farland silt loam, 1 to 3 percent slopes
FaB	Farland silt loam, 3 to 6 percent slopes
FbE	Flasher-Badland complex, 9 to 40 percent slopes
FhD	Flasher soils, 3 to 15 percent slopes
FhE	Flasher soils, 15 to 40 percent slopes
FkE	Fleak-Badland complex, 9 to 40 percent slopes
FlD	Fleak soils, 3 to 15 percent slopes
FlE	Fleak soils, 15 to 40 percent slopes
Fu	Fluvaquentic Haplaquolls
GlA	Glendive fine sandy loam, 1 to 3 percent slopes
GlB	Glendive fine sandy loam, 3 to 6 percent slopes
GoC	Golva silt loam, 6 to 9 percent slopes
GrA	Grail silt loam, 1 to 3 percent slopes
GrB	Grail silt loam, 3 to 6 percent slopes
GtA	Grail silty clay loam, 1 to 3 percent slopes
GtB	Grail silty clay loam, 3 to 6 percent slopes
GwA	Grassna silt loam, 1 to 3 percent slopes
GxB	Grassna and Golva silt loams, 3 to 6 percent slopes
HaA	Hanly soils, 1 to 3 percent slopes
Hc	Harriet complex
HeA	Havre soils, 1 to 3 percent slopes
Hz	Heil and McKenzie soils
KcA	Korchea loam, 1 to 3 percent slopes
Kh	Korchea and Havre soils, channeled
KrB	Kremlin loam, 1 to 6 percent slopes
KrC	Kremlin loam, 6 to 9 percent slopes
LaA	Lawther silty clay, 1 to 3 percent slopes
LaB	Lawther silty clay, 3 to 6 percent slopes
Lc	Lawther-Rhoades silty clays
LdA	Lawther clay, sandy subsoil variant, 1 to 3 percent slopes
LdC	Lawther clay, sandy subsoil variant, 3 to 9 percent slopes
LeB	Lefor-Vebar fine sandy loams, 1 to 6 percent slopes
LeC	Lefor-Vebar fine sandy loams, 6 to 9 percent slopes
MaA	Manning fine sandy loam, 1 to 3 percent slopes
MaB	Manning fine sandy loam, 3 to 6 percent slopes
MeA	Moreau silty clay, 1 to 3 percent slopes
MeB	Moreau silty clay, 3 to 6 percent slopes
MeC	Moreau silty clay, 6 to 9 percent slopes
MoA	Morton silt loam, 1 to 3 percent slopes
MoB	Morton silt loam, 3 to 6 percent slopes
MoC	Morton silt loam, 6 to 9 percent slopes
MpA	Morton complex, 1 to 3 percent slopes
MpB	Morton complex, 3 to 6 percent slopes
MpC	Morton complex, 6 to 9 percent slopes
MrB	Morton-Rhoades silt loams, 3 to 6 percent slopes
MrC	Morton-Rhoades silt loams, 6 to 9 percent slopes
MsA	Mott sandy loam, 1 to 3 percent slopes
MsB	Mott sandy loam, 3 to 6 percent slopes
MtA	Mott loam, 1 to 3 percent slopes
MtB	Mott loam, 3 to 6 percent slopes
PaB	Parshall fine sandy loam, 1 to 6 percent slopes
PeB	Patent loam, 3 to 6 percent slopes
PeD	Patent loam, 6 to 15 percent slopes
PsD	Patent-Sham-Gullied land complex, 3 to 15 percent slopes
ReA	Reeder loam, 1 to 3 percent slopes
ReB	Reeder loam, 3 to 6 percent slopes
ReC	Reeder loam, 6 to 9 percent slopes
RgA	Regent silty clay loam, 1 to 3 percent slopes
RgB	Regent silty clay loam, 3 to 6 percent slopes
RhA	Regent-Rhoades silty clay loams, 1 to 3 percent slopes
RhC	Regent-Rhoades silty clay loams, 3 to 9 percent slopes
RkB	Rhame-Chinook fine sandy loams, 3 to 6 percent slopes
RkC	Rhame-Chinook fine sandy loams, 6 to 9 percent slopes
RmC	Rhame-Fleak fine sandy loams, 6 to 9 percent slopes
RmD	Rhame-Fleak fine sandy loams, 9 to 15 percent slopes
RsA	Rhoades-Belfield complex, 1 to 3 percent slopes
RsC	Rhoades-Belfield complex, 3 to 9 percent slopes
RxB	Rhoades complex, 1 to 6 percent slopes
SgA	Savage silty clay loam, 1 to 3 percent slopes
SgB	Savage silty clay loam, 3 to 6 percent slopes
ShA	Savage-Rhoades silty clay loams, 1 to 3 percent slopes
SlB	Searing loam, 3 to 6 percent slopes
SmB	Searing-Ringling stony loams, 3 to 6 percent slopes
SnA	Sen silt loam, 1 to 3 percent slopes
SnB	Sen silt loam, 3 to 6 percent slopes
SnC	Sen silt loam, 6 to 9 percent slopes
SoB	Sen-Golva silt loams, 3 to 6 percent slopes
SoC	Sen-Golva silt loams, 6 to 9 percent slopes
SrD	Sen and Amor soils, 9 to 15 percent slopes
SsC	Sham complex, 1 to 9 percent slopes
StA	Shambo loam, 1 to 3 percent slopes
StB	Shambo loam, 3 to 6 percent slopes
SyA	Stady loam, 1 to 3 percent slopes
SyB	Stady loam, 3 to 6 percent slopes
SzC	Stady and Manning soils, 6 to 9 percent slopes
TaA	Tally fine sandy loam, 1 to 3 percent slopes
TaB	Tally fine sandy loam, 3 to 6 percent slopes
TeB	Telfer-Lihen loamy fine sands, 1 to 6 percent slopes
TeC	Telfer-Lihen loamy fine sands, 6 to 9 percent slopes
VfC	Vebar-Flasher fine sandy loams, 3 to 9 percent slopes
VfD	Vebar-Flasher fine sandy loams, 9 to 15 percent slopes
VrB	Vebar-Tally fine sandy loams, 3 to 6 percent slopes
VrC	Vebar-Tally fine sandy loams, 6 to 9 percent slopes
WaE	Wabek loam, 3 to 25 percent slopes
WyC	Wayden silty clay, 1 to 9 percent slopes
YeE	Yetull loamy coarse sand, 6 to 25 percent slopes
ZfC	Zeona loamy fine sand, 1 to 9 percent slopes

SLOPE COUNTY, NORTH DAKOTA NO. 1

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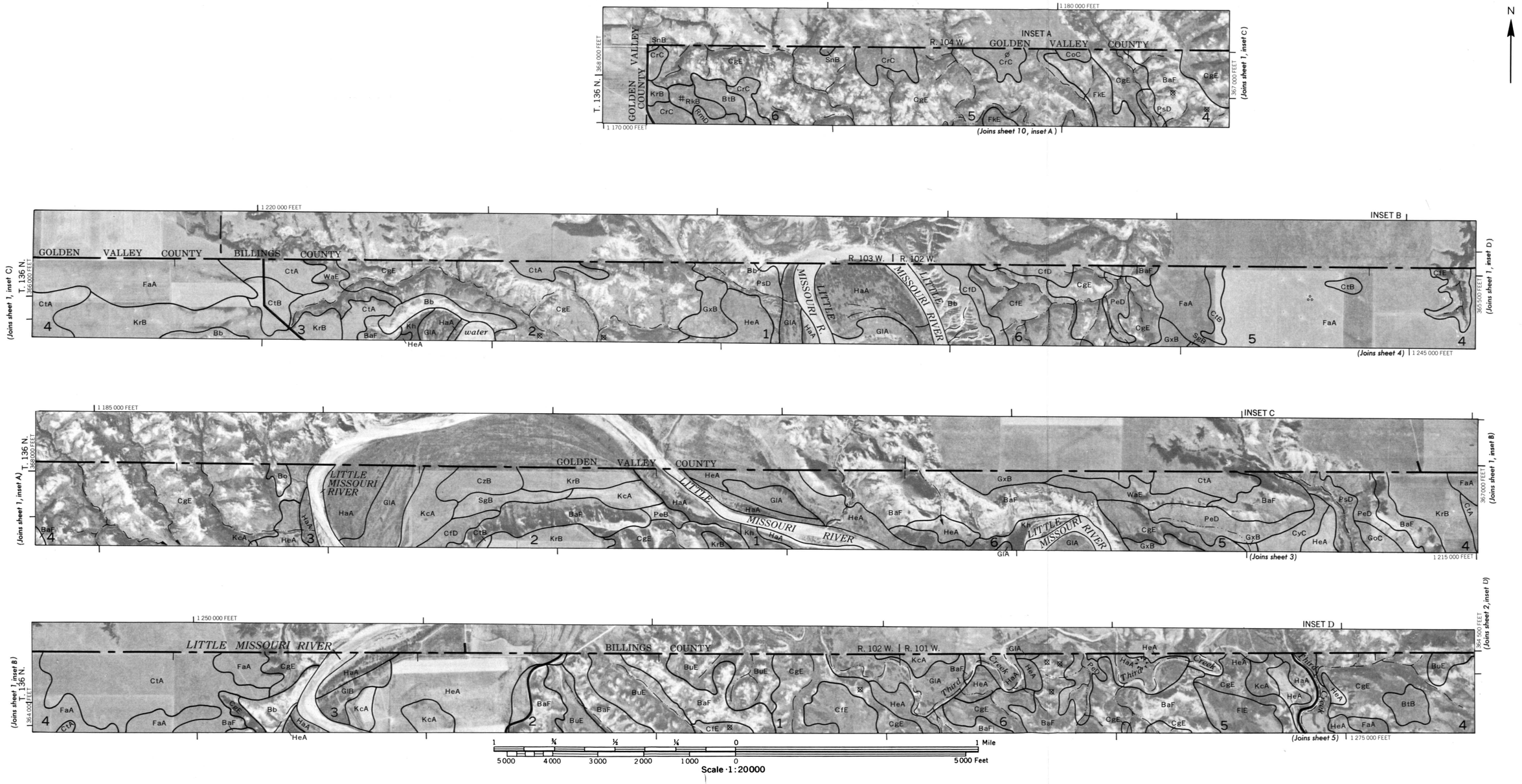
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 1



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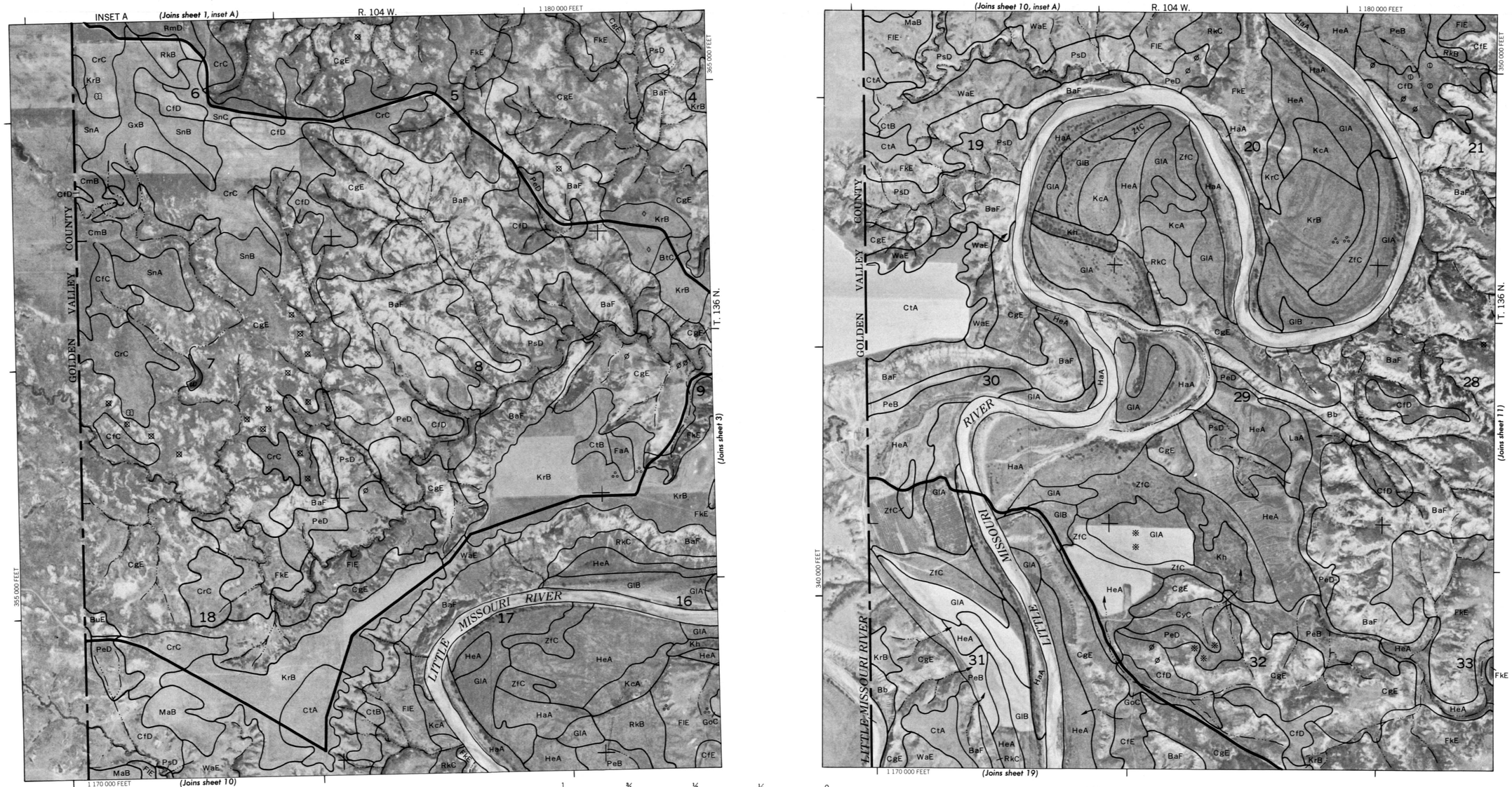

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale · 1 : 20000

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SLOPE COUNTY, NORTH DAKOTA NO. 10

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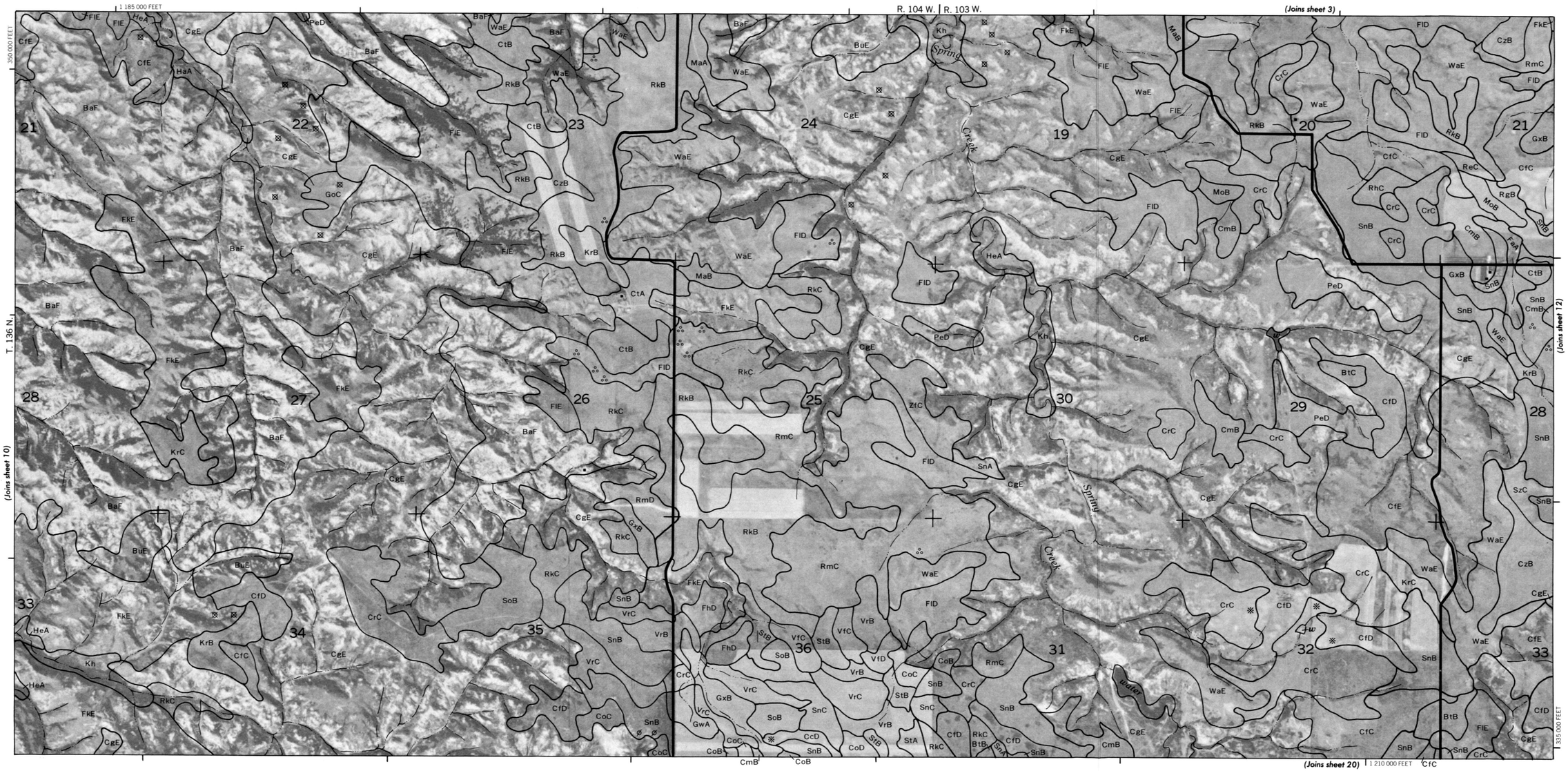

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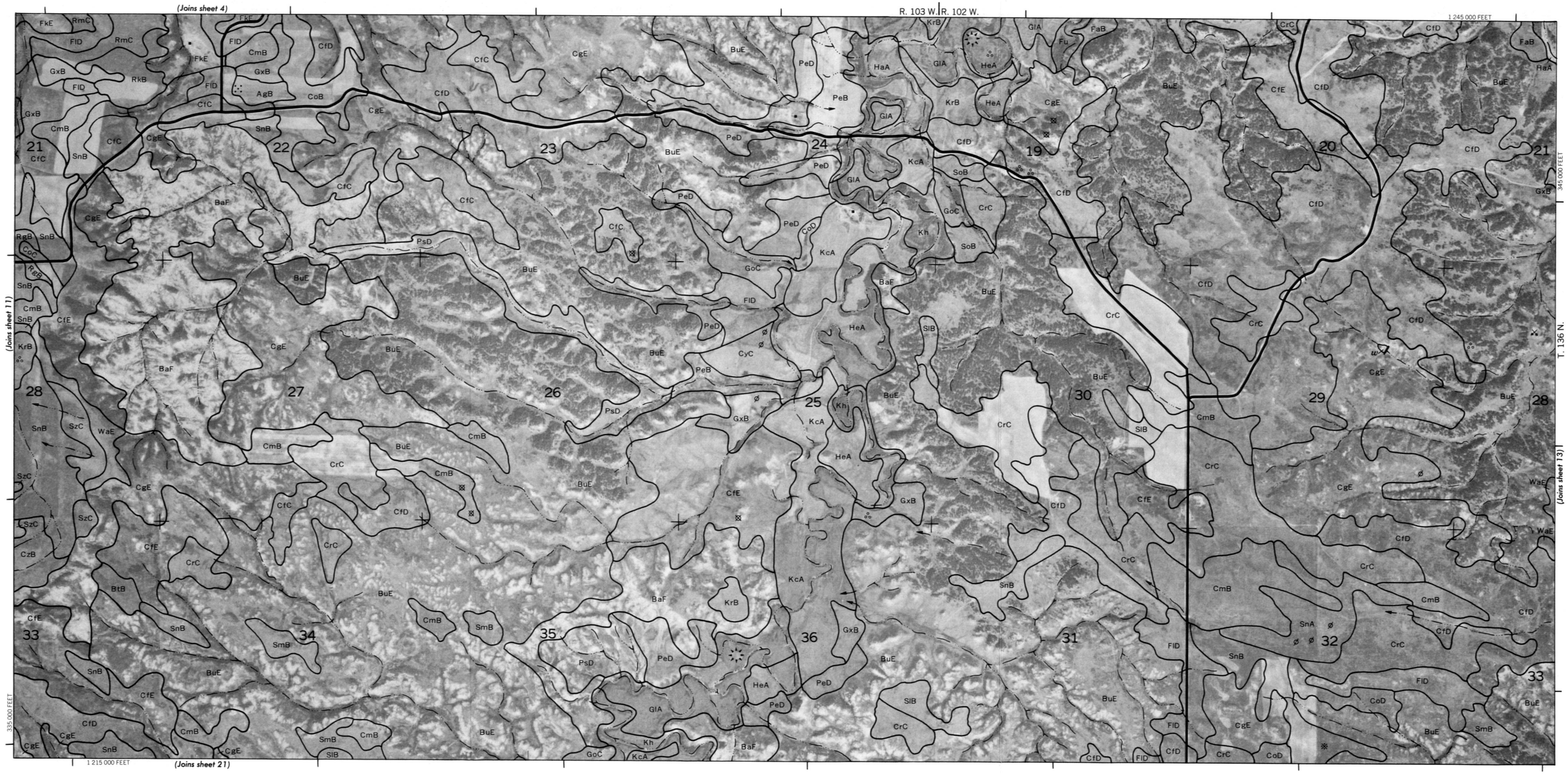

1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale · 1 : 20000

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SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 13

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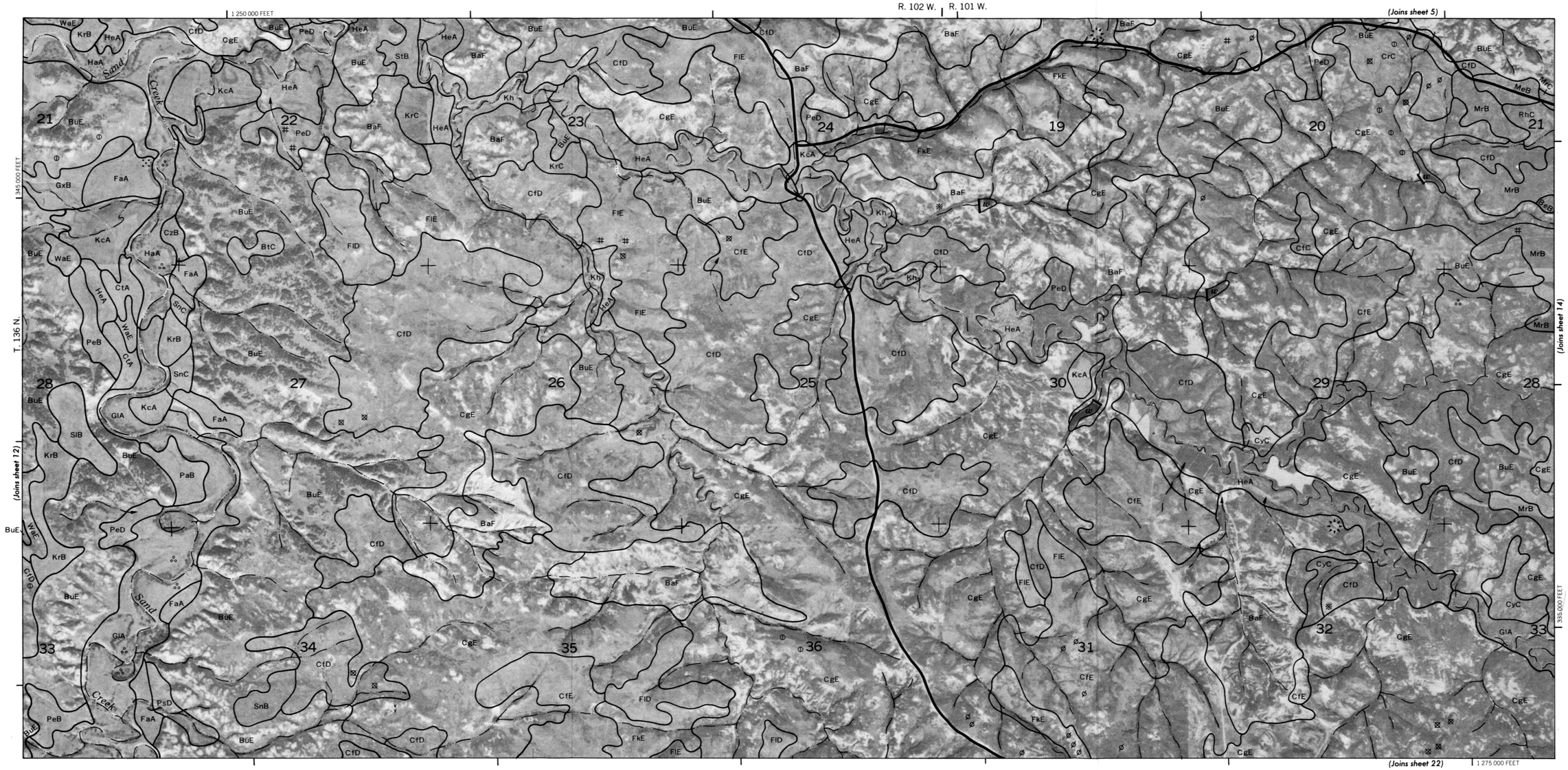

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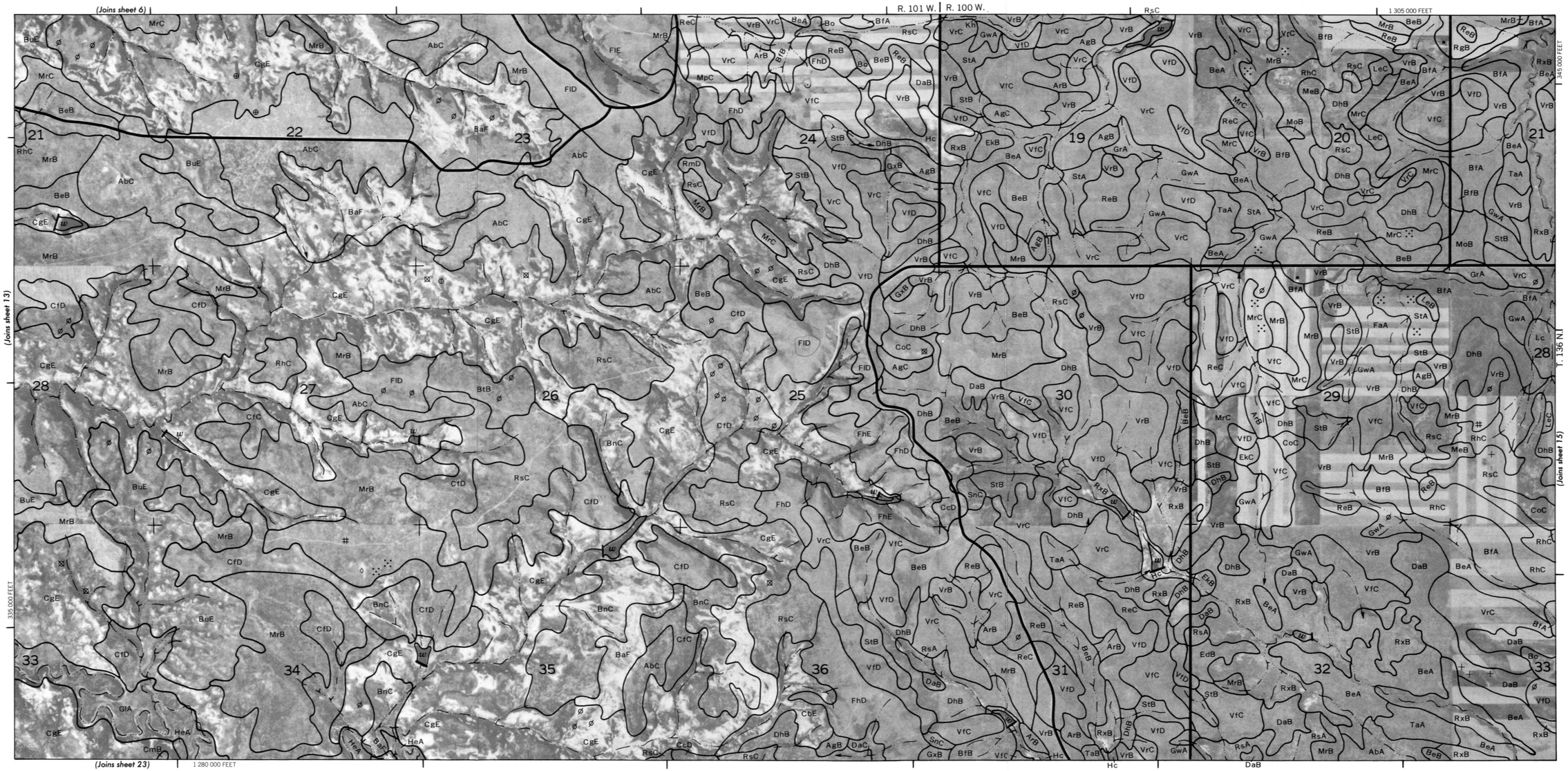
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 14



1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

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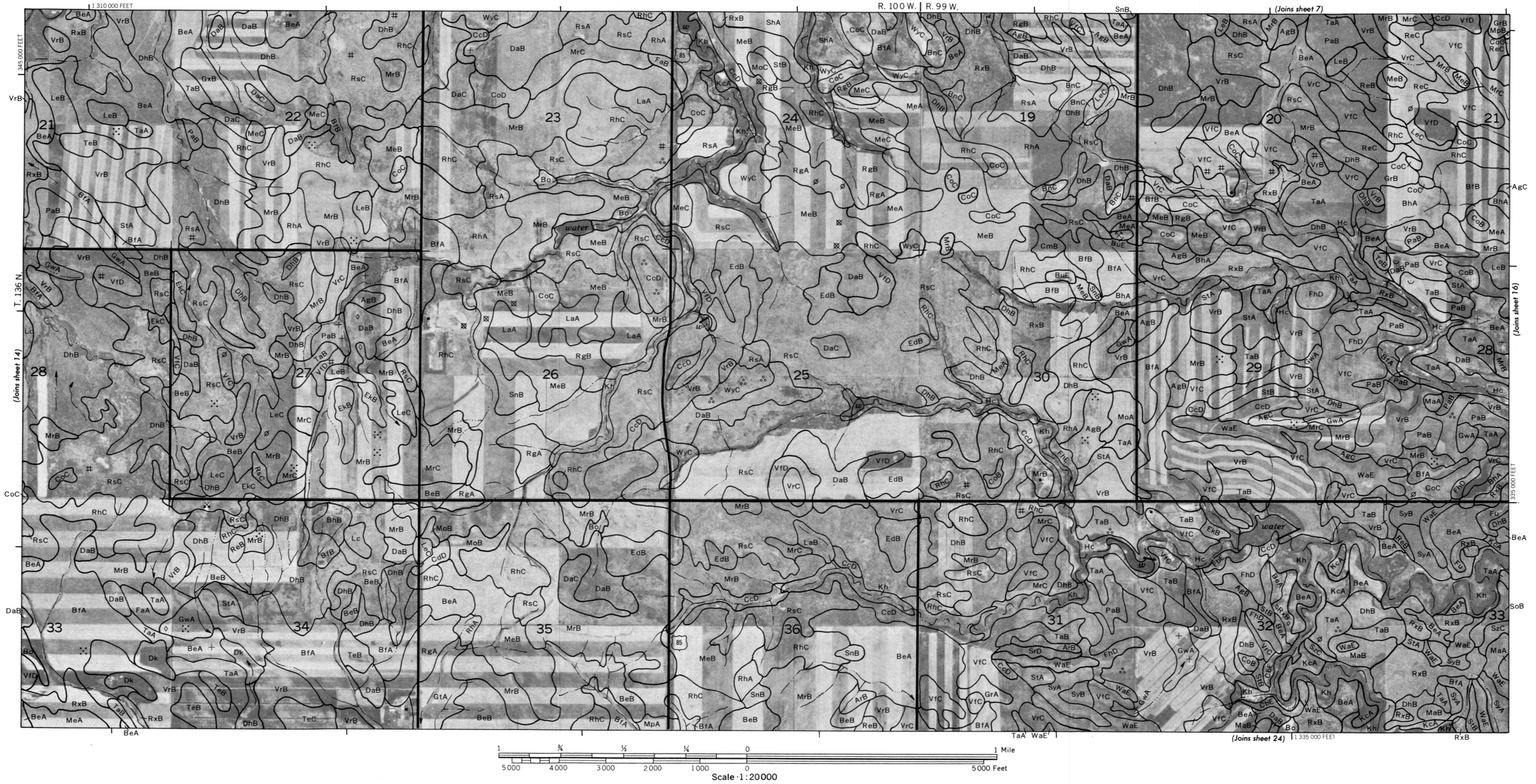

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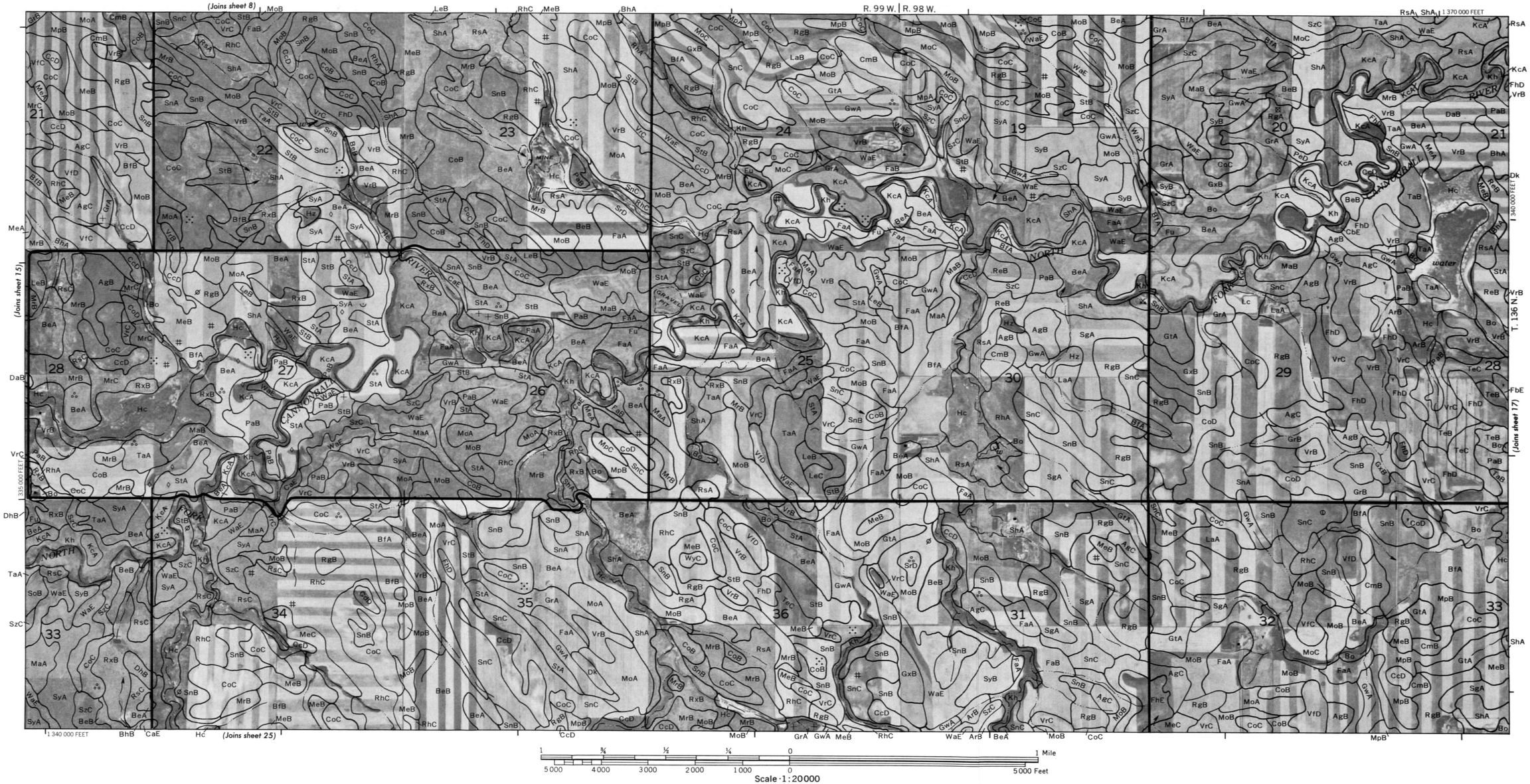

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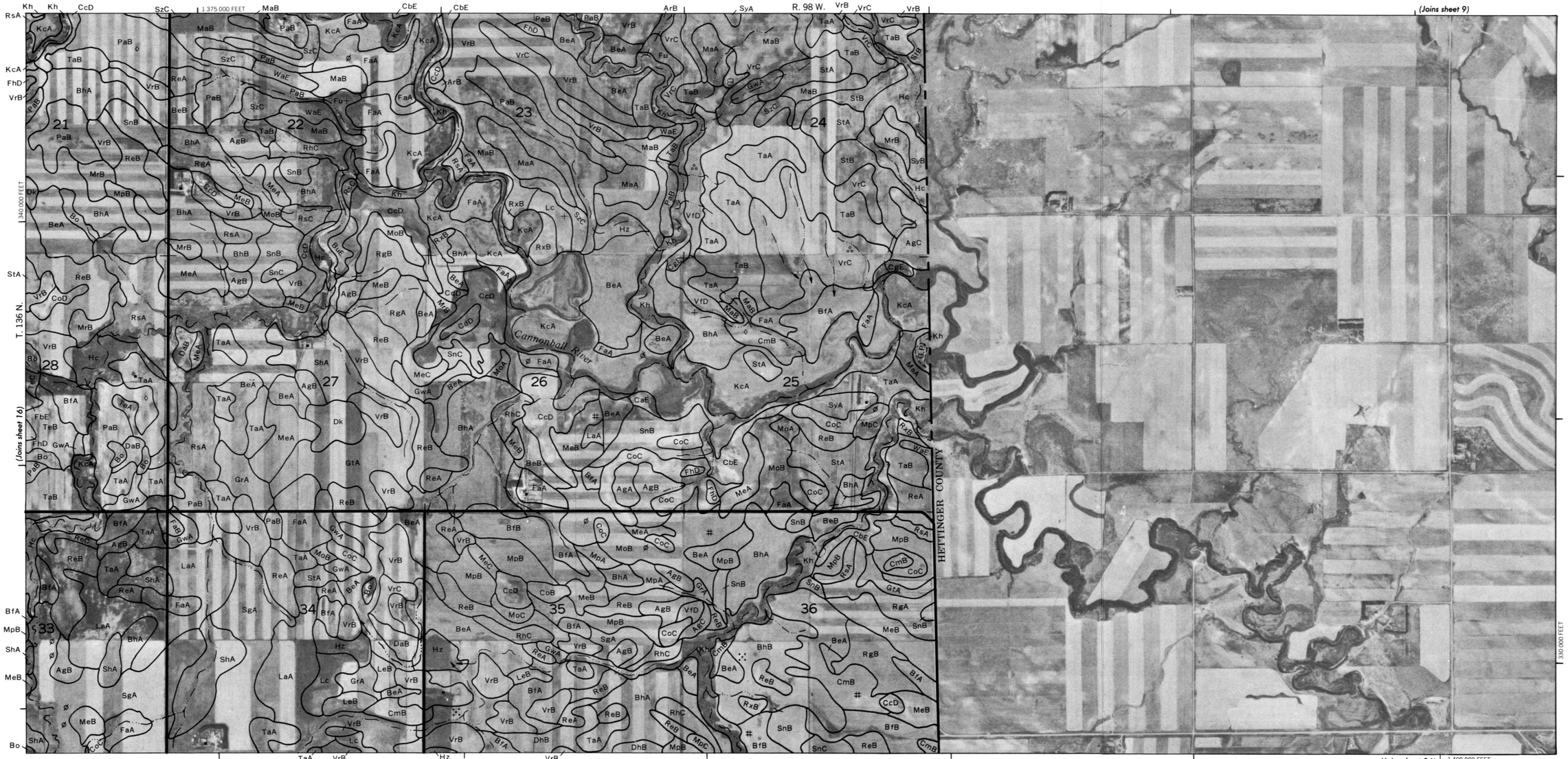
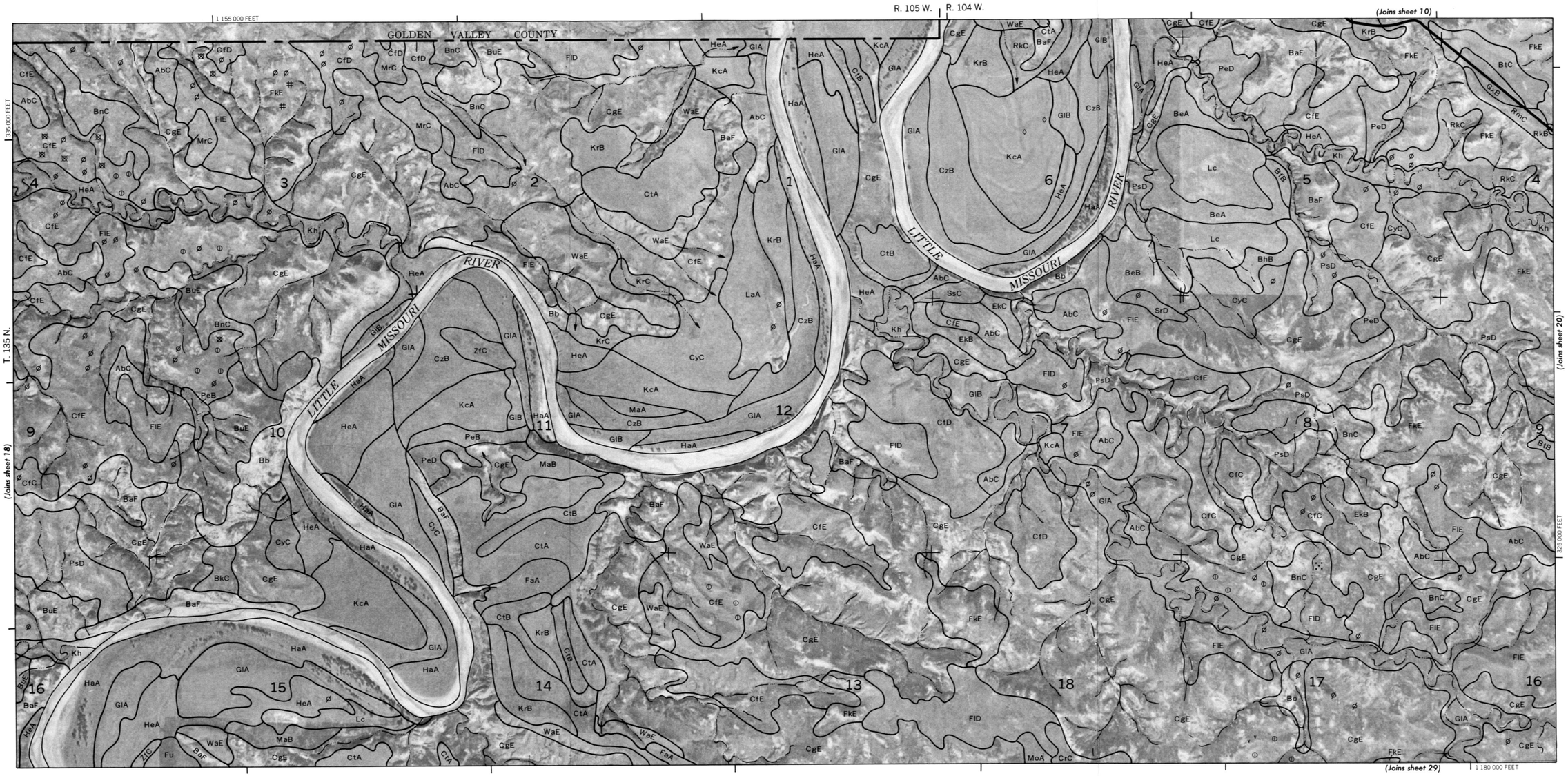


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 stereoscopic aerophotographs obtained from U. S. Department of the Interior, Geological Survey.

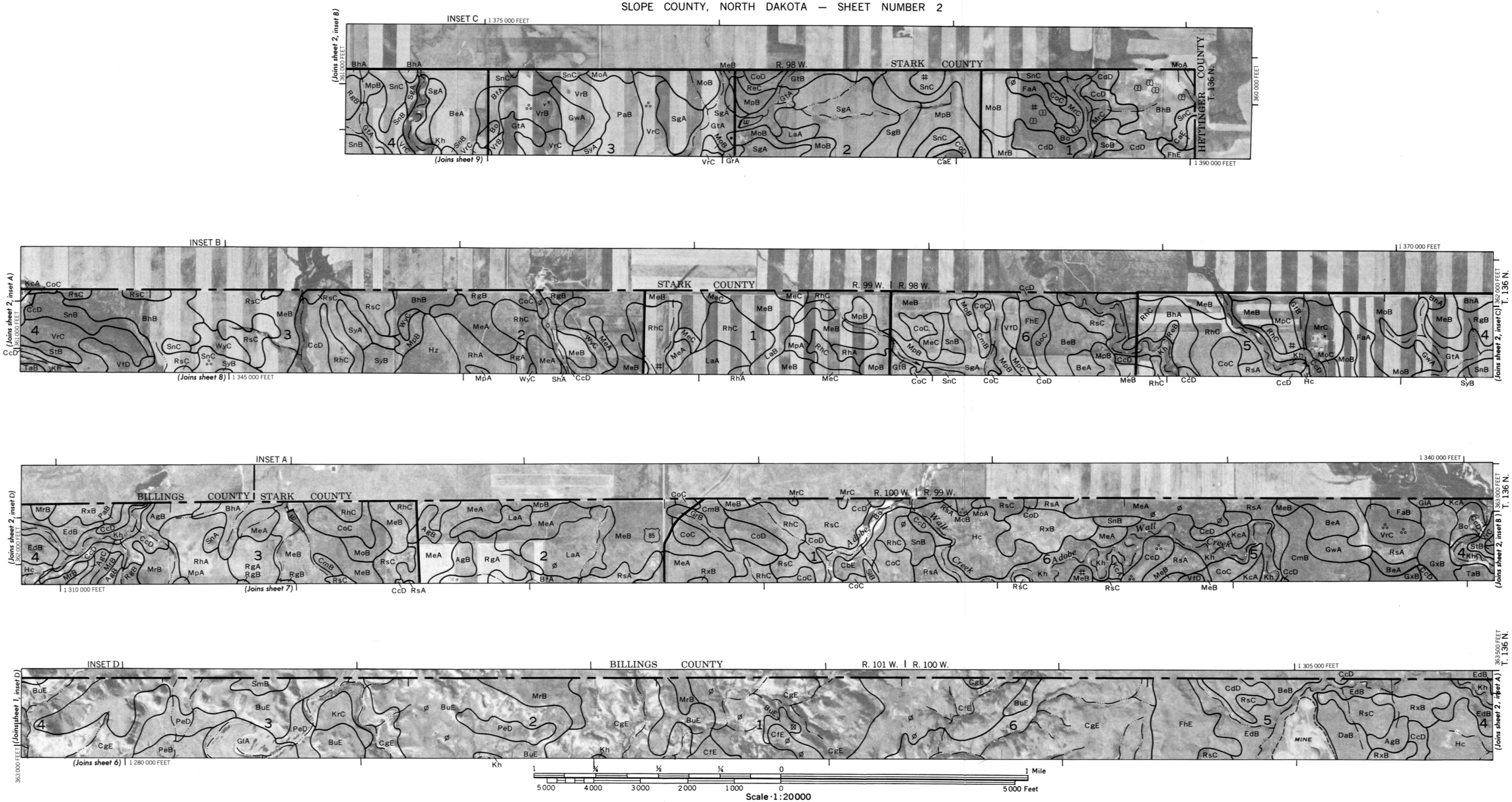
N



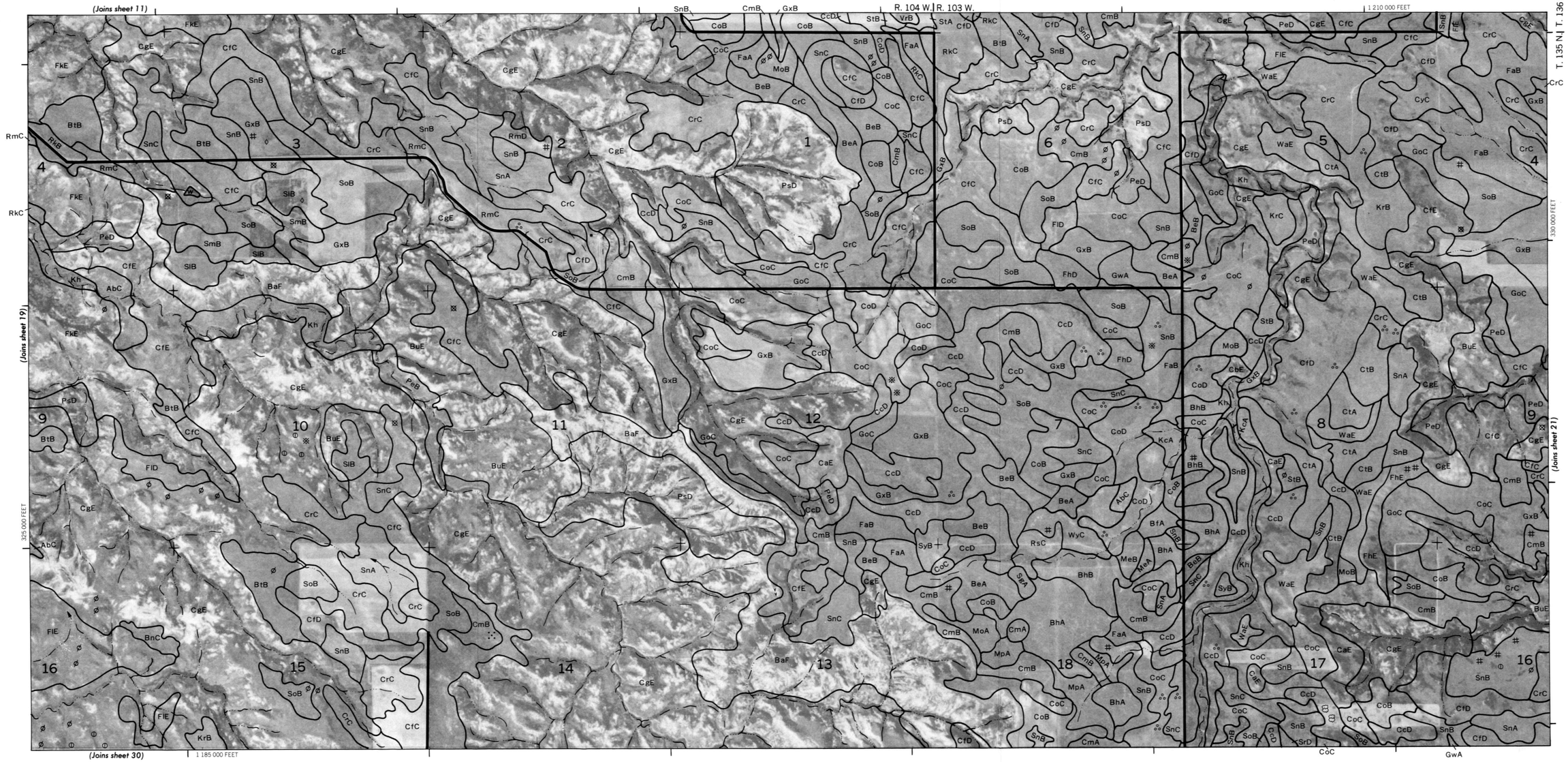
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

N

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 2

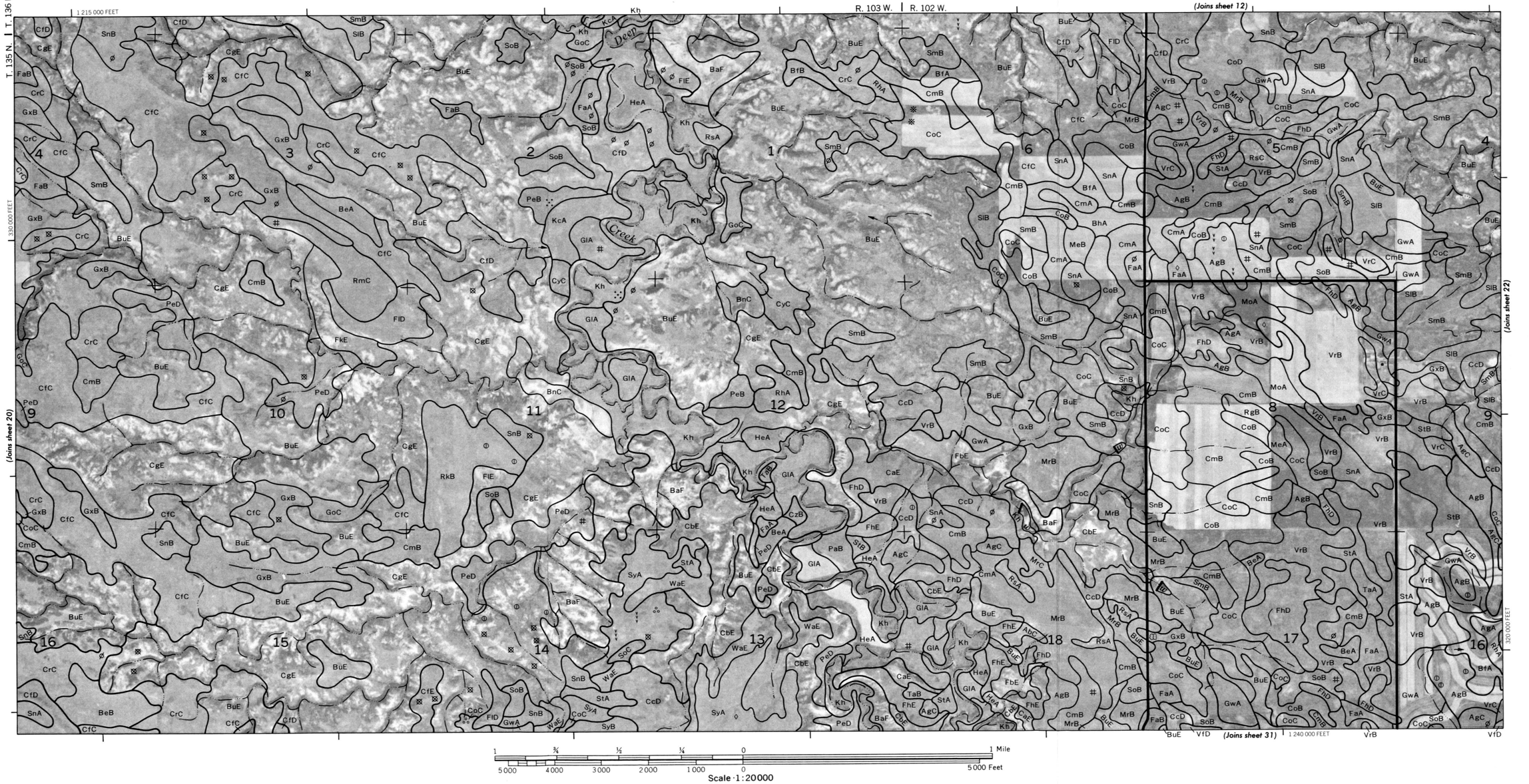


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1976 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

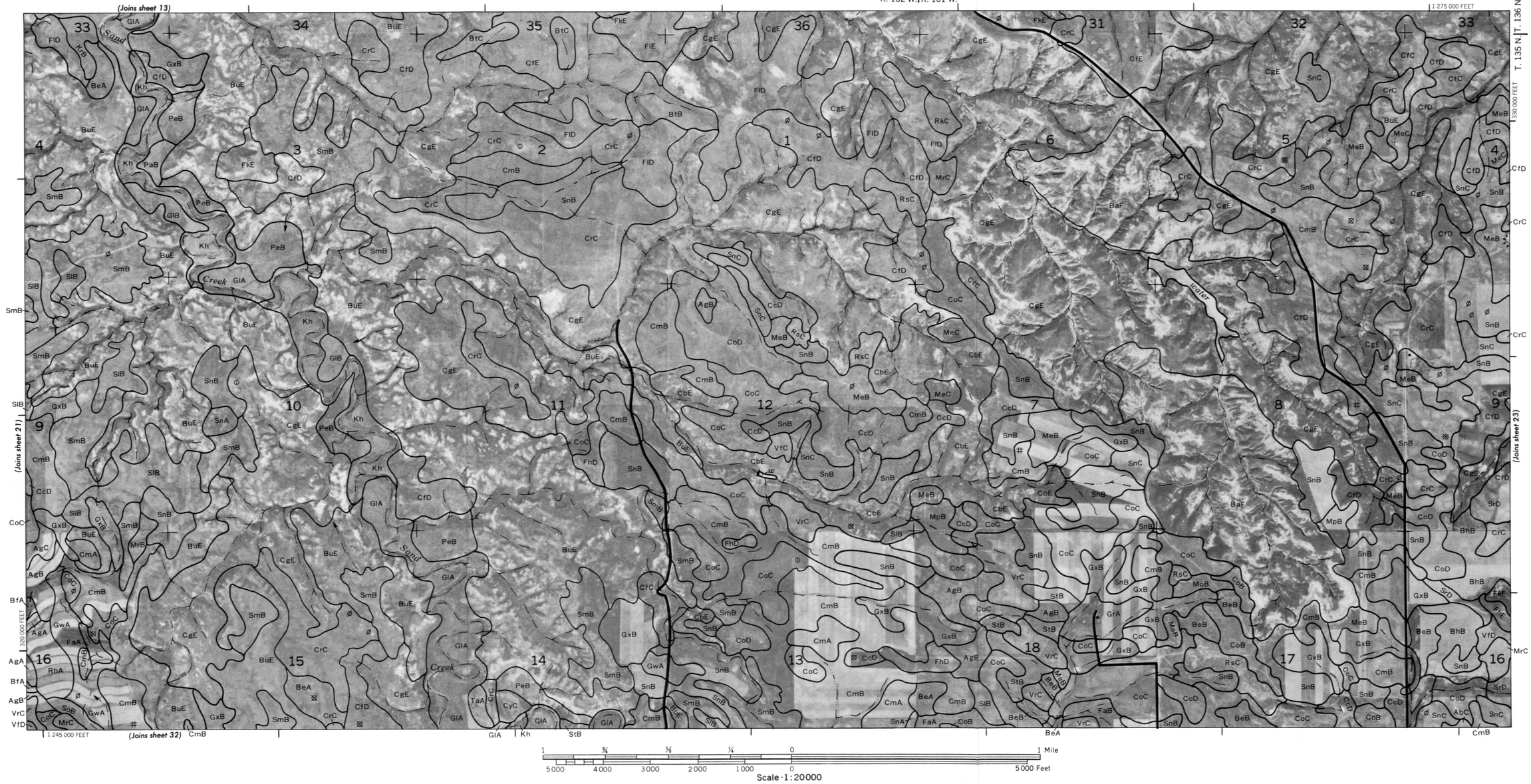


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies on 1974 and 1976 photography obtained from U. S. Department of the Interior, Geological Survey



SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 22

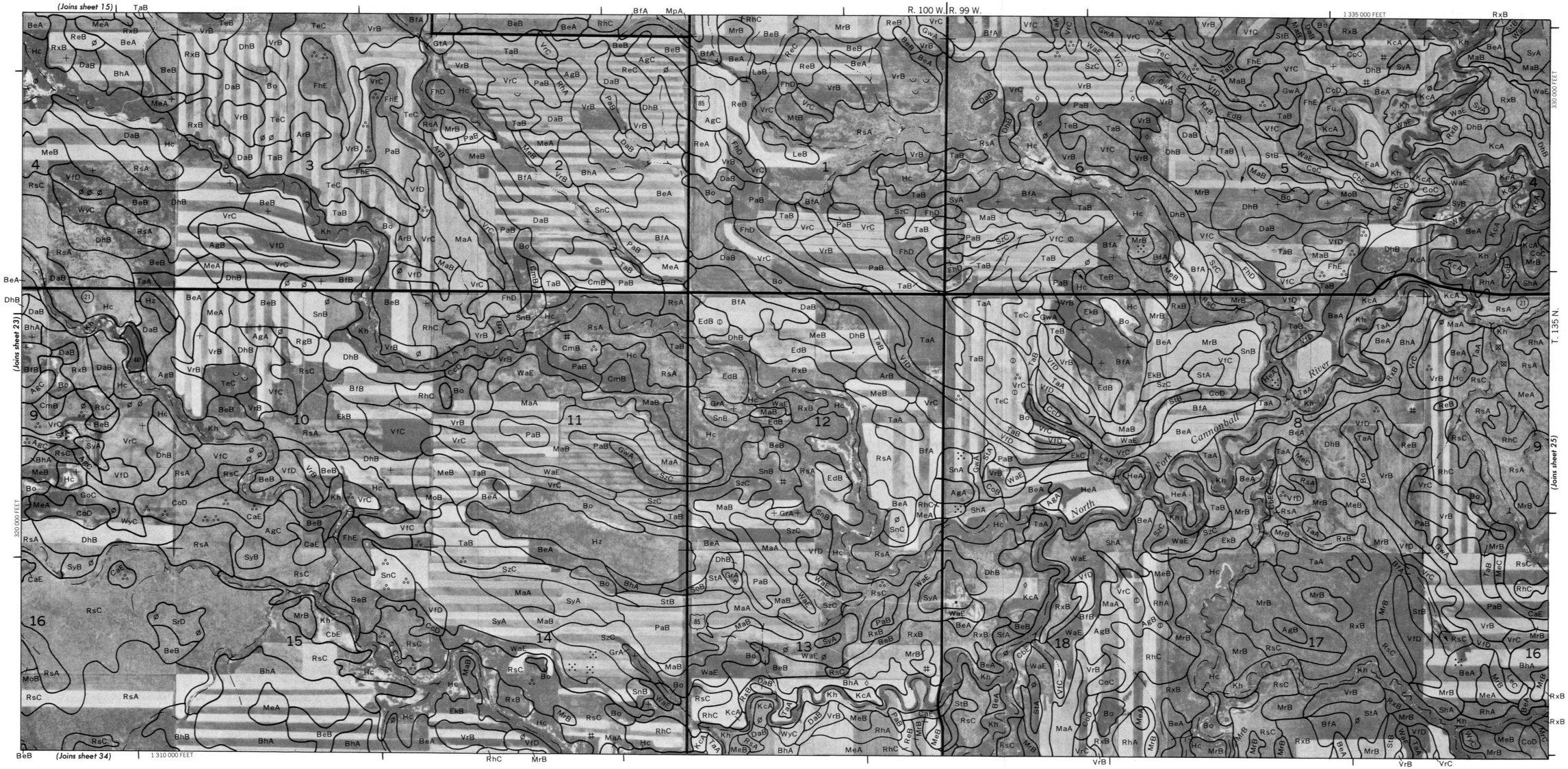


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 soil data. Orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 22

N

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 24



1 ¾ ½ ¼ 0 1 Mile

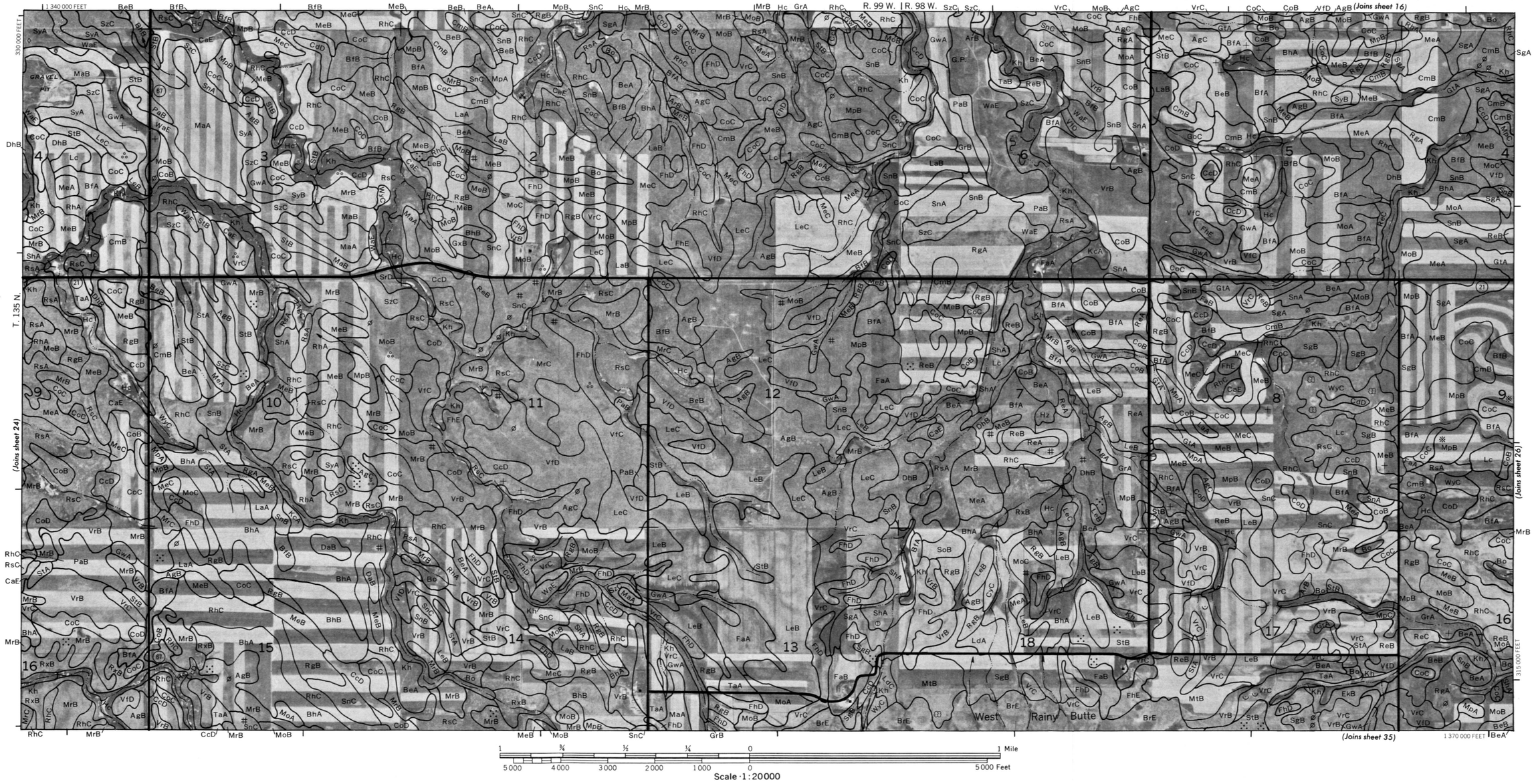
5000 4000 3000 2000 1000 0 5000 Feet

Scale · 1 : 20000

This map was compiled by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from the U. S. Department of the Interior, Geological Survey

SLOPE COUNTY, NORTH DAKOTA NO. 24

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 25



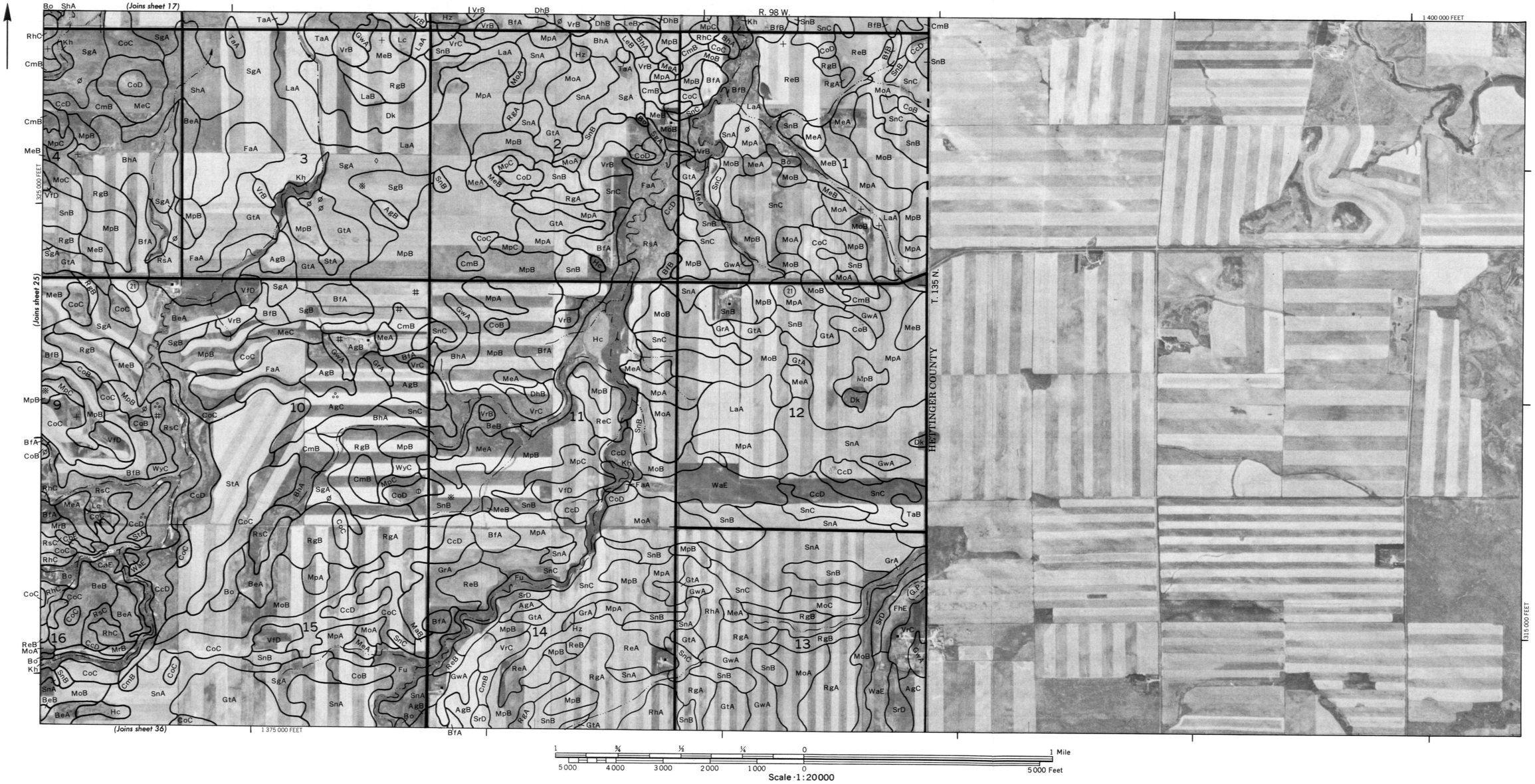
25

N

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior - Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 25

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 26

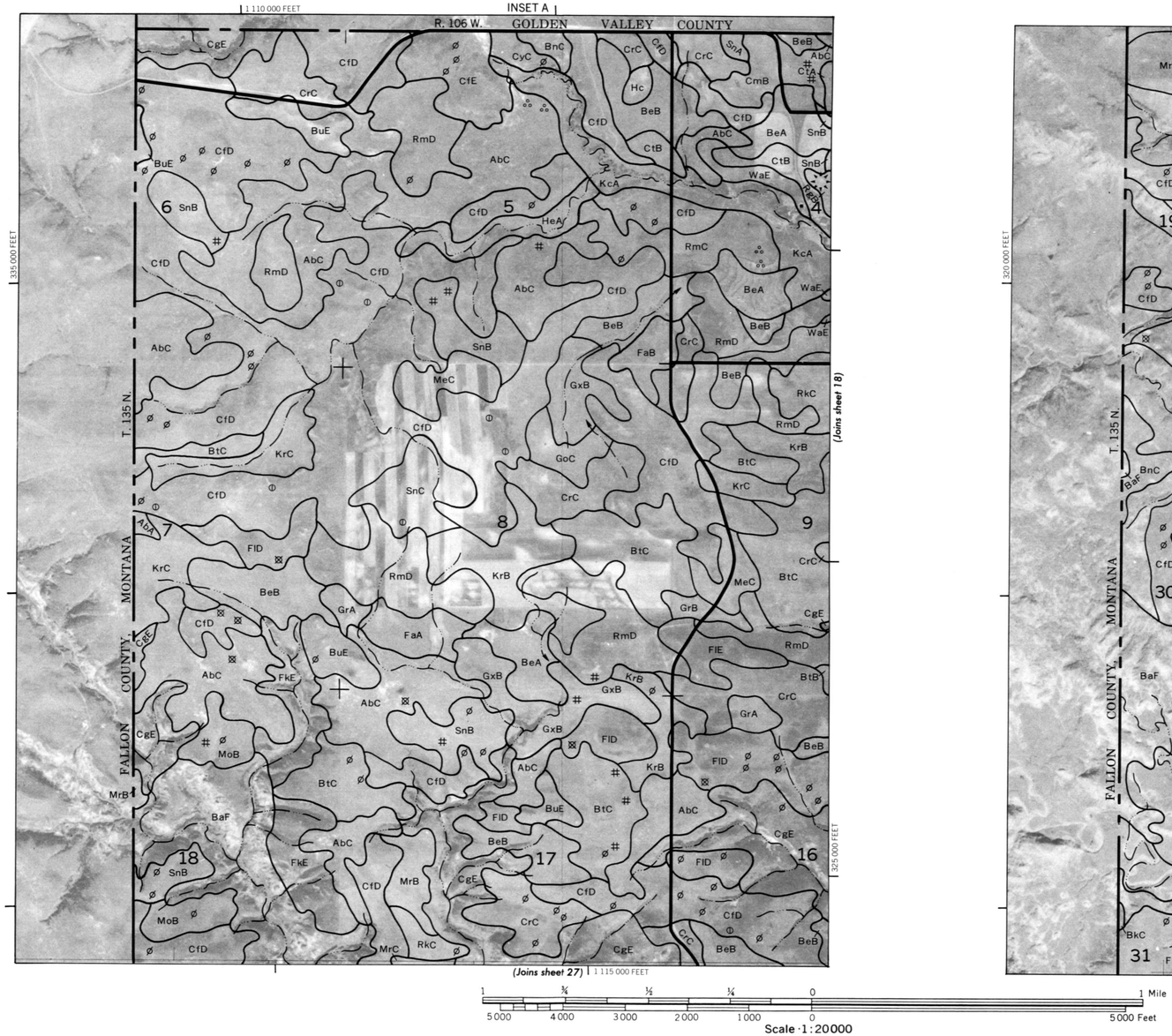


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 stereophotography obtained from U. S. Department of the Interior, Geological Survey.

N

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 27

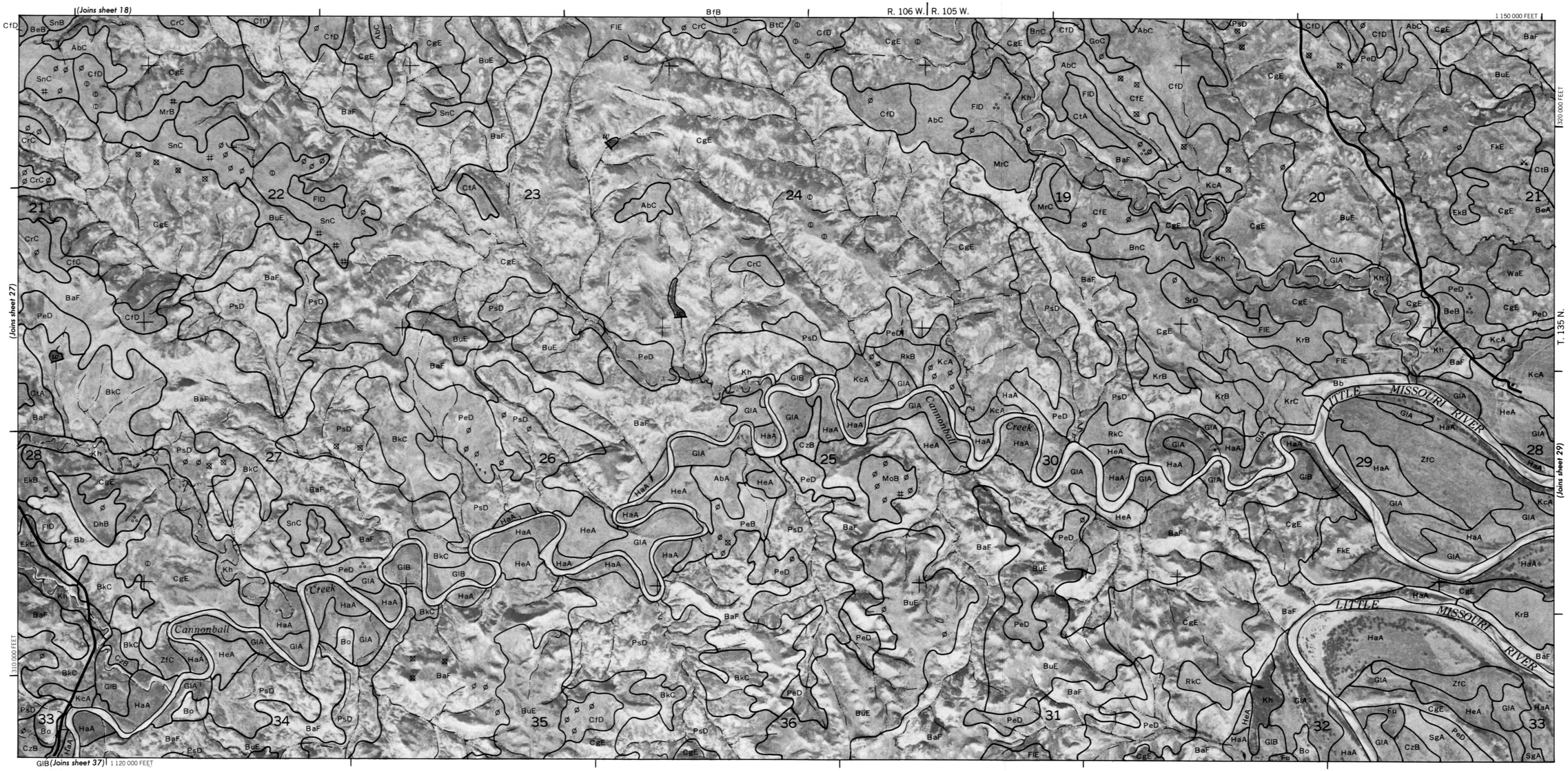


1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale · 1 : 20000

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 28



1 ¾ ½ ¼ 0 1 Mile

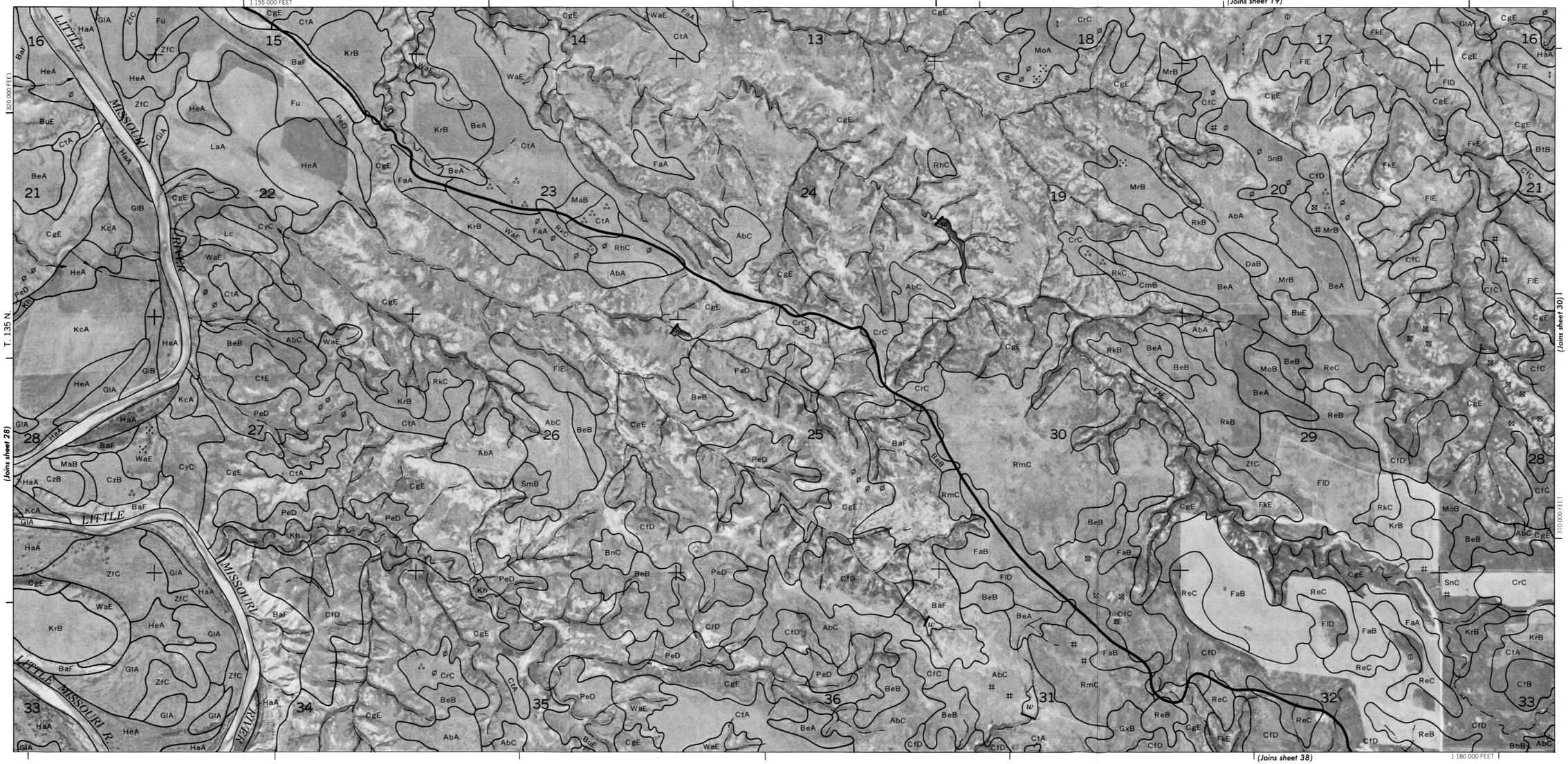
5000 4000 3000 2000 1000 0 5000 Feet

Scale · 1 : 20000

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1976 orthophotography obtained from U. S. Department of the Interior, (Geological Survey).

SLOPE COUNTY, NORTH DAKOTA NO. 28

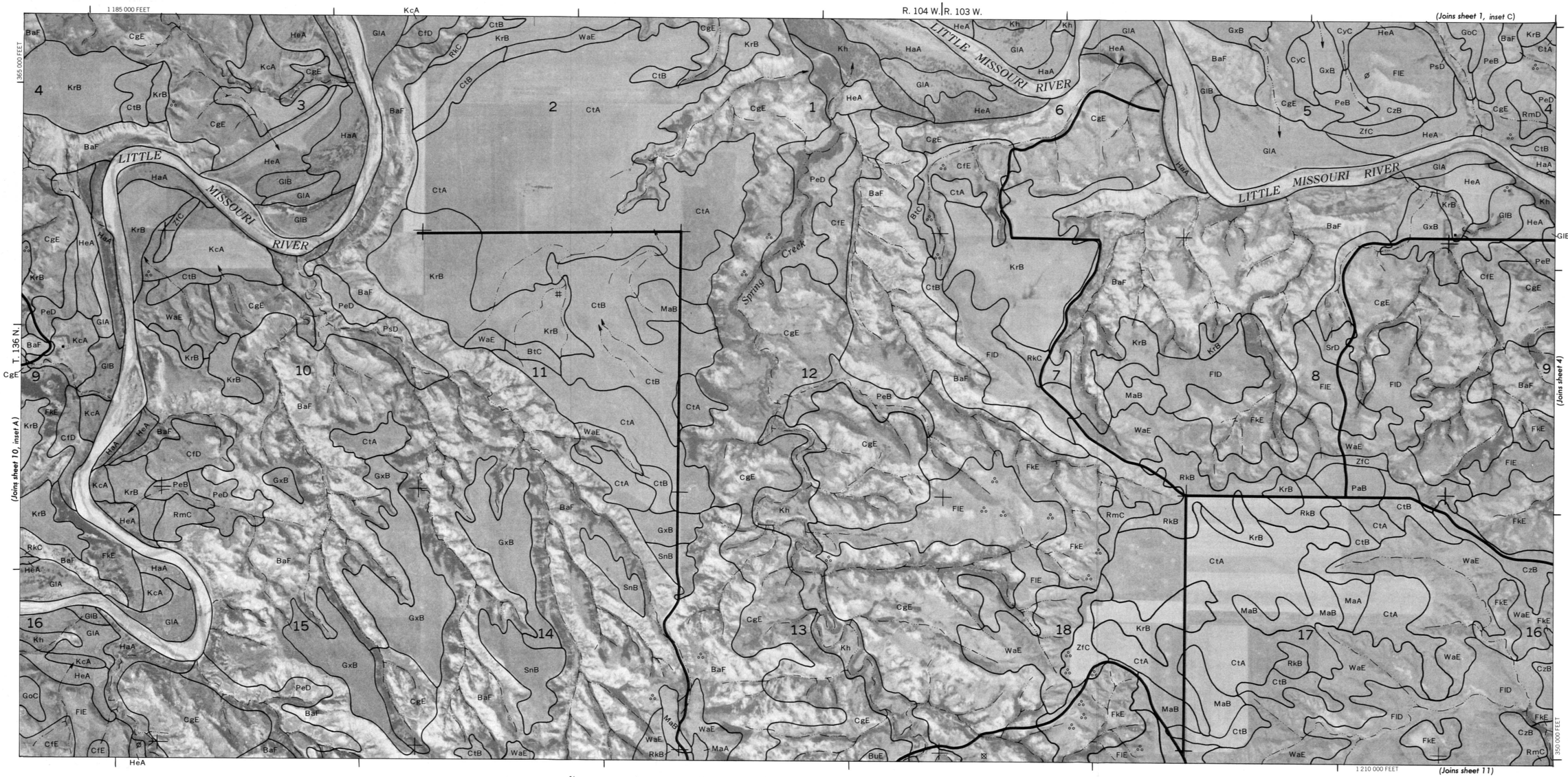
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.



SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 3

3

N



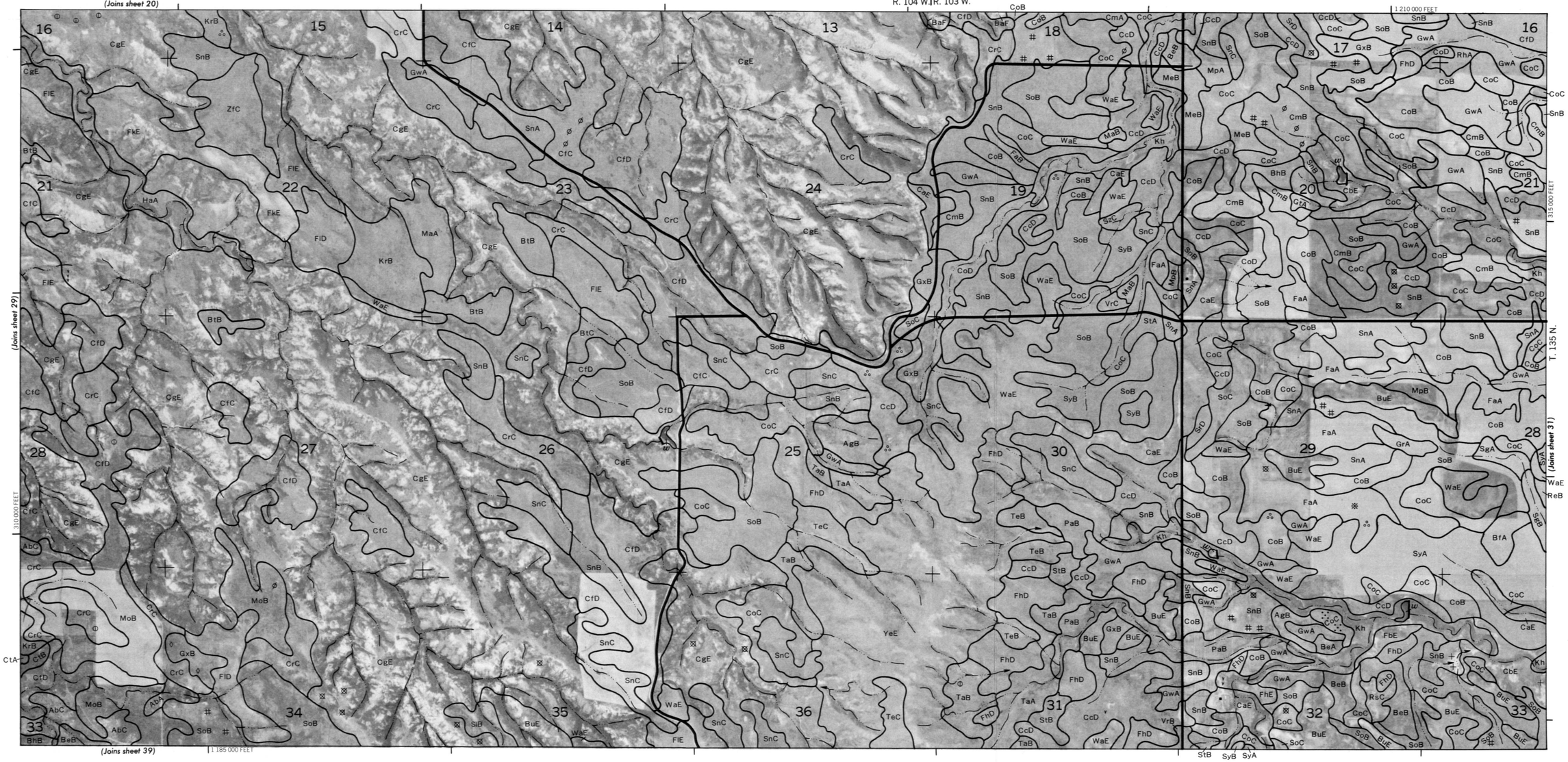
SLOPE COUNTY, NORTH DAKOTA NO. 3

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1976 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

30

N

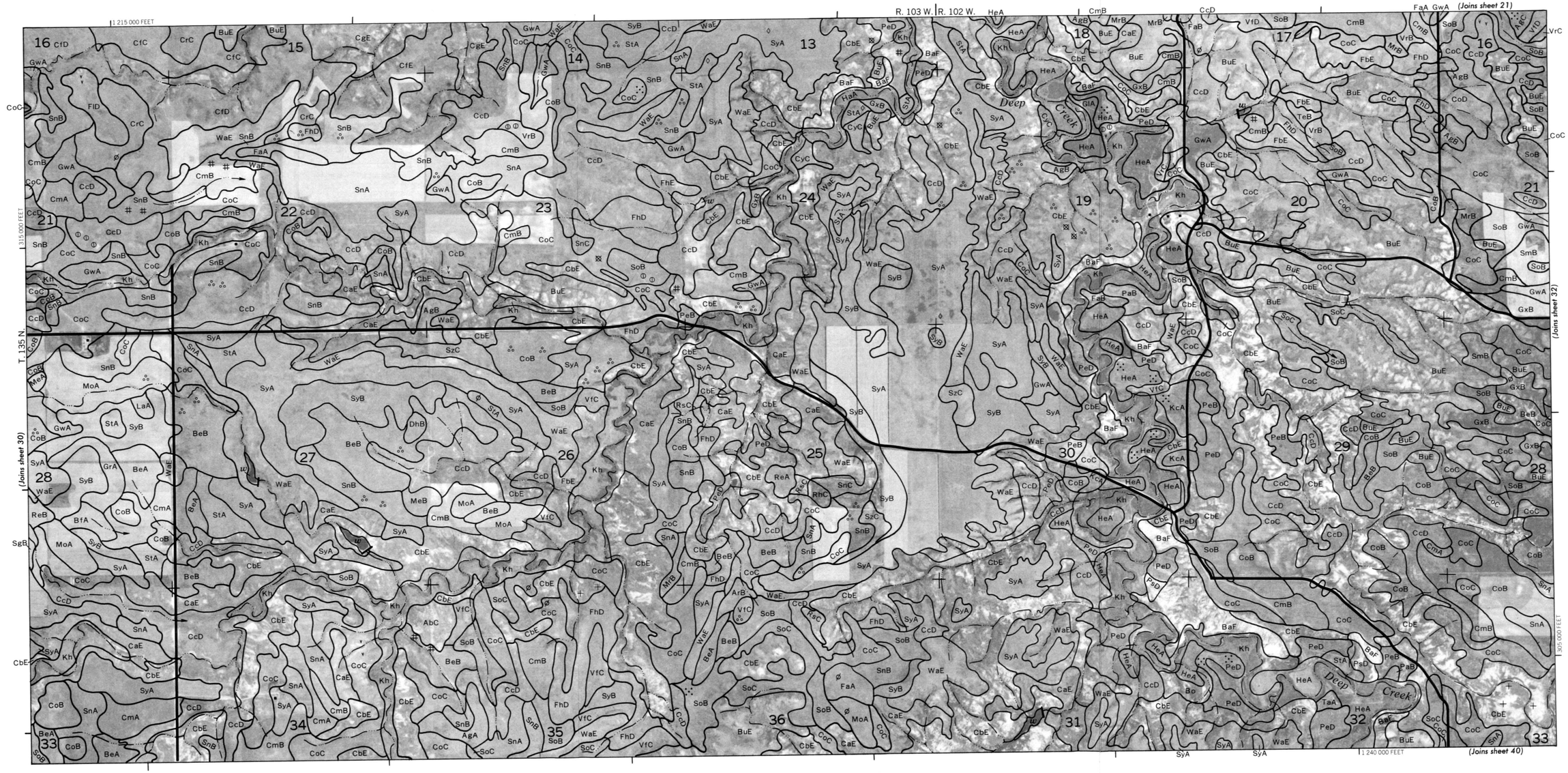
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 30



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1976 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 30

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 31



N

1 ¾ ½ ¼ 0 1 Mile

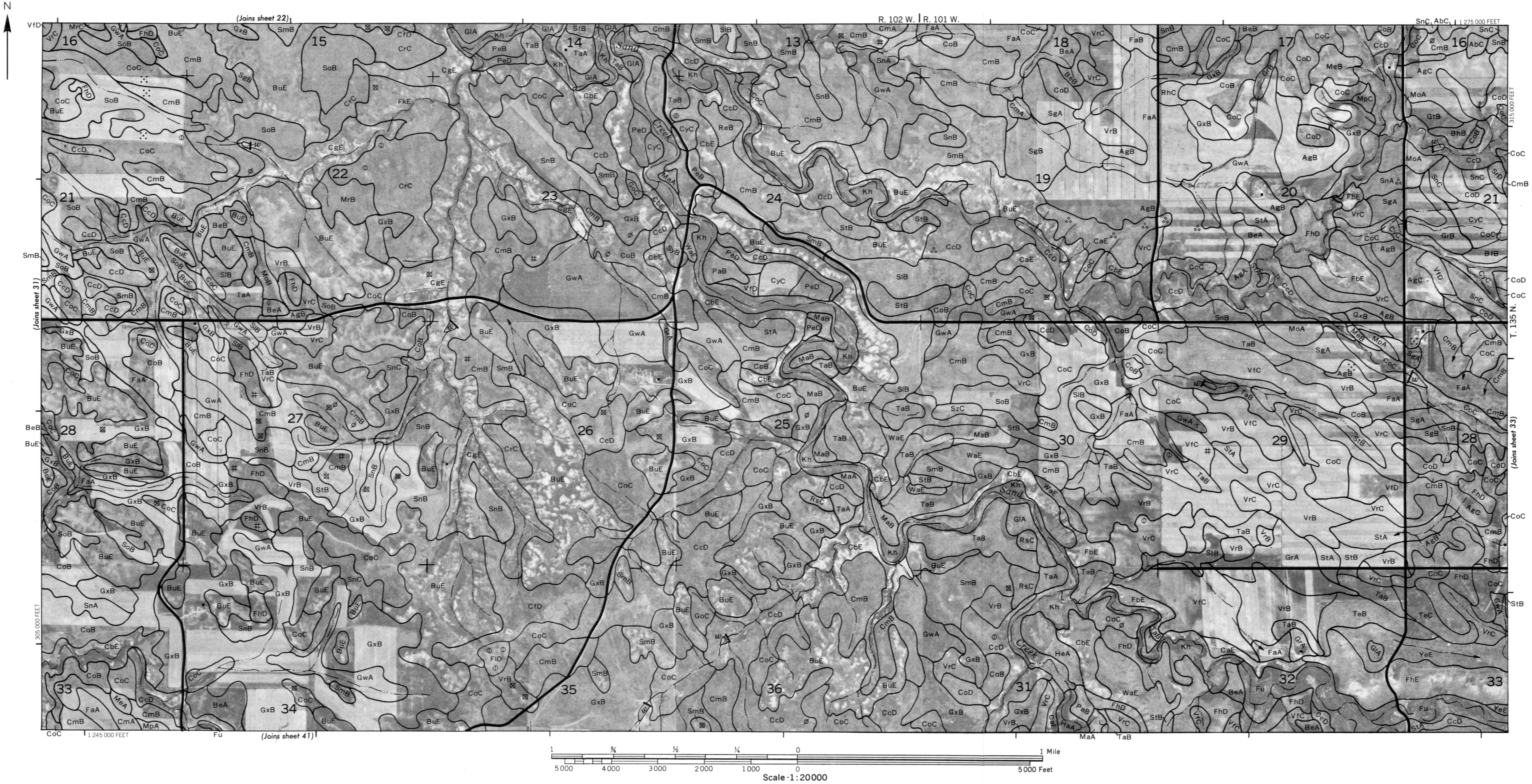
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1:31 and 1:63 360 photography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 31

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 32

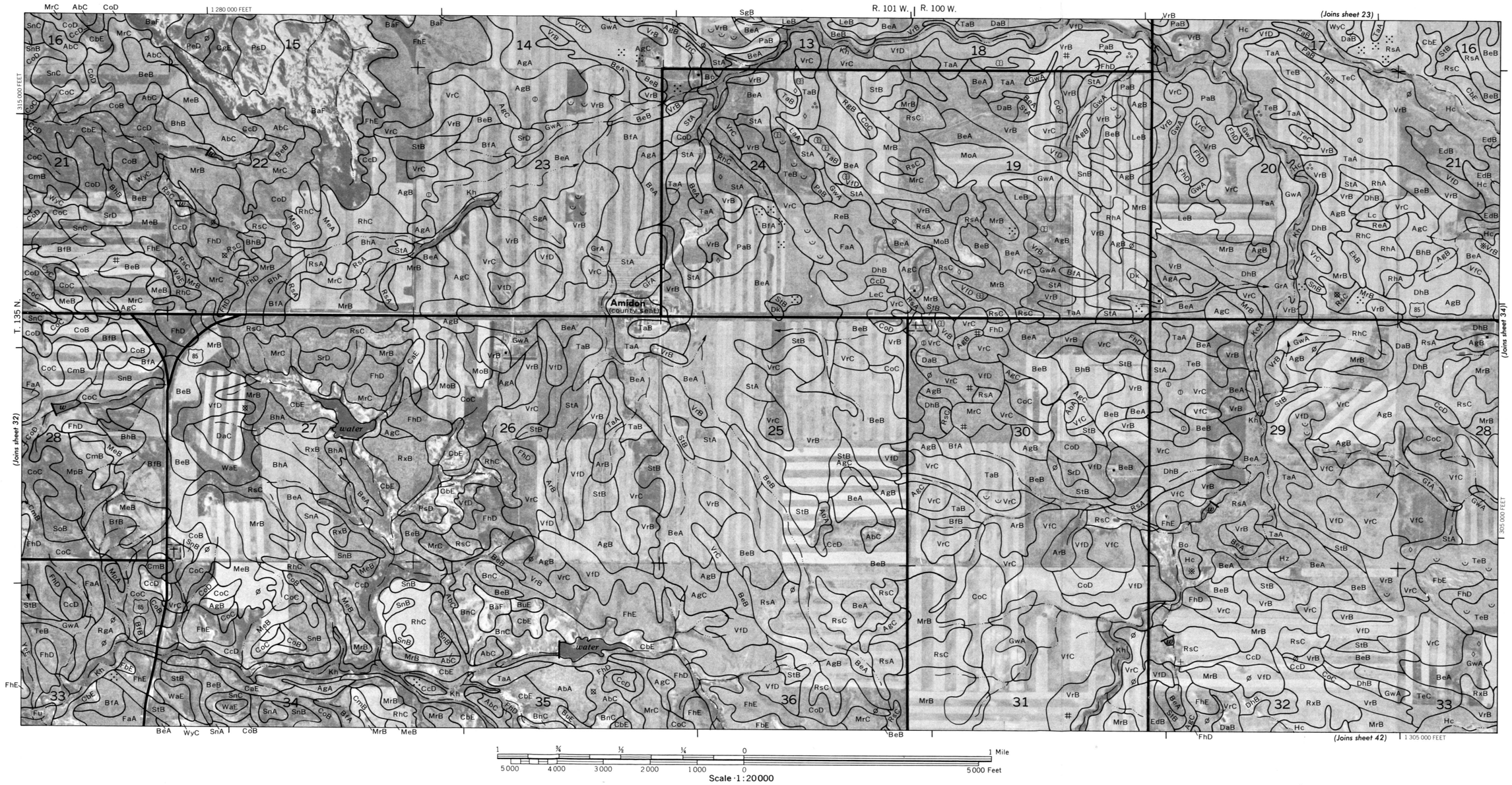


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 32

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 33

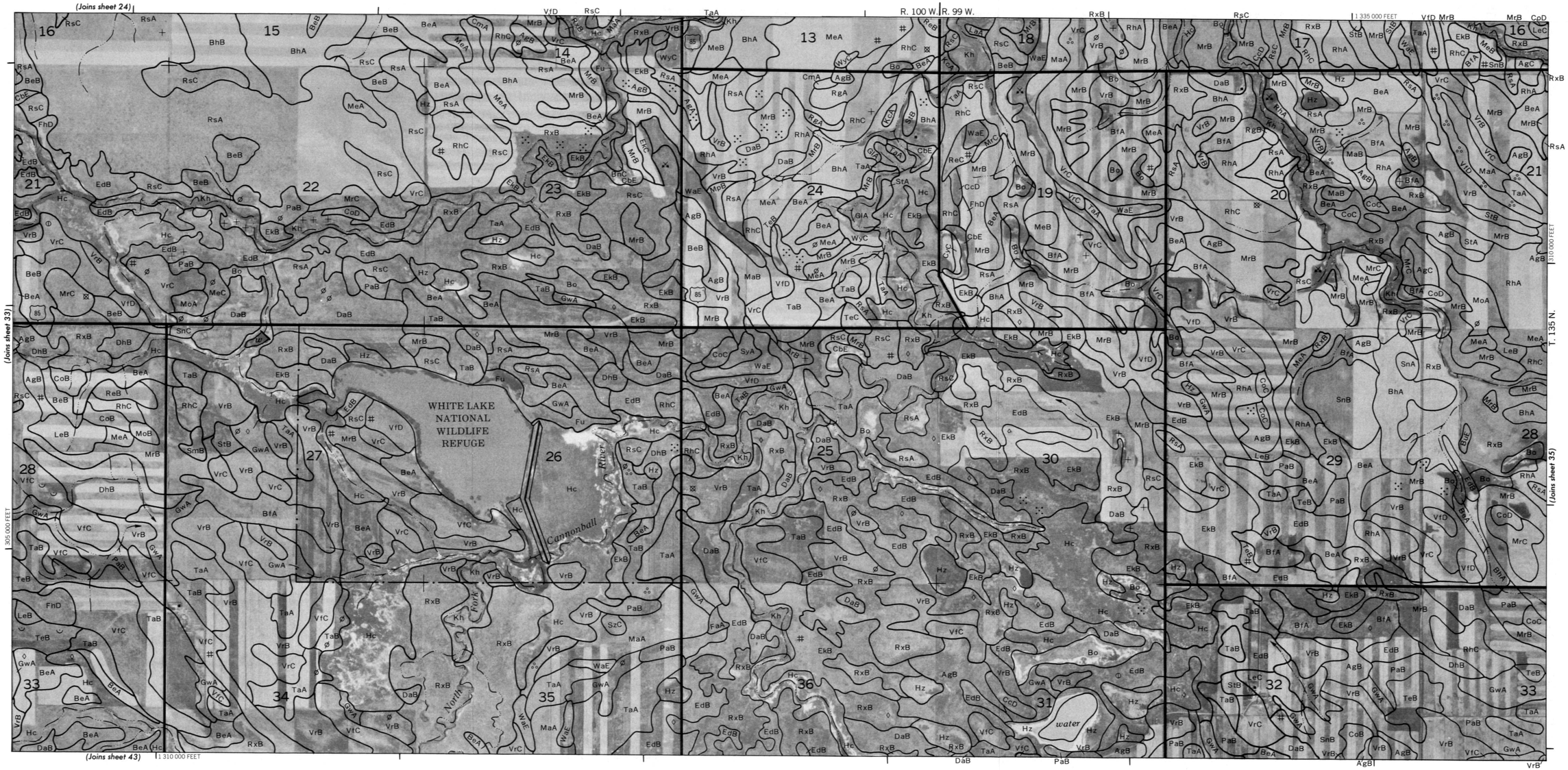
33



SLOPE COUNTY, NORTH DAKOTA NO. 33

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 34

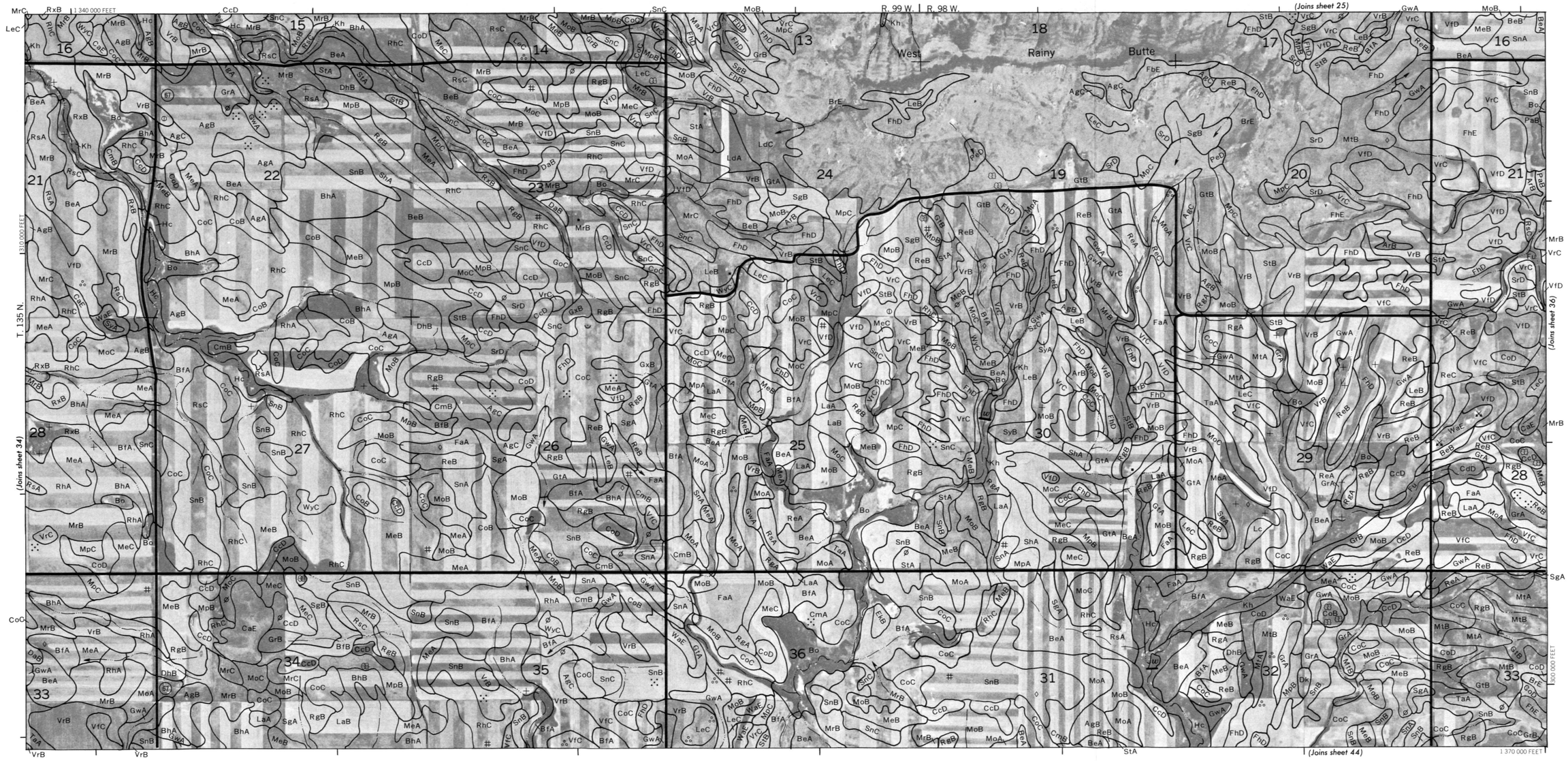


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

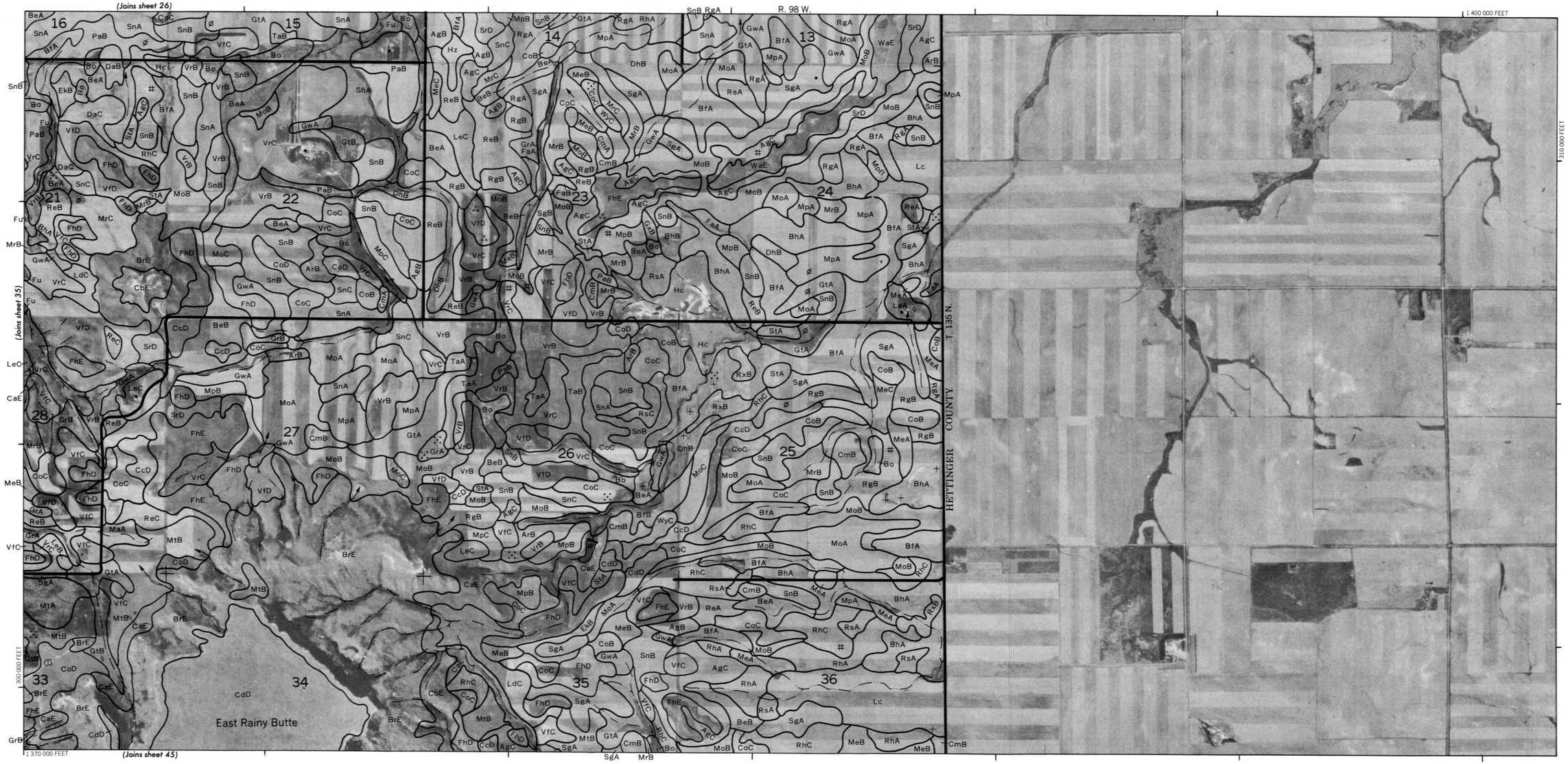
SLOPE COUNTY, NORTH DAKOTA NO. 34

SLOPE COUNTY, NORTH DAKOTA NO. 35

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey



SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 36

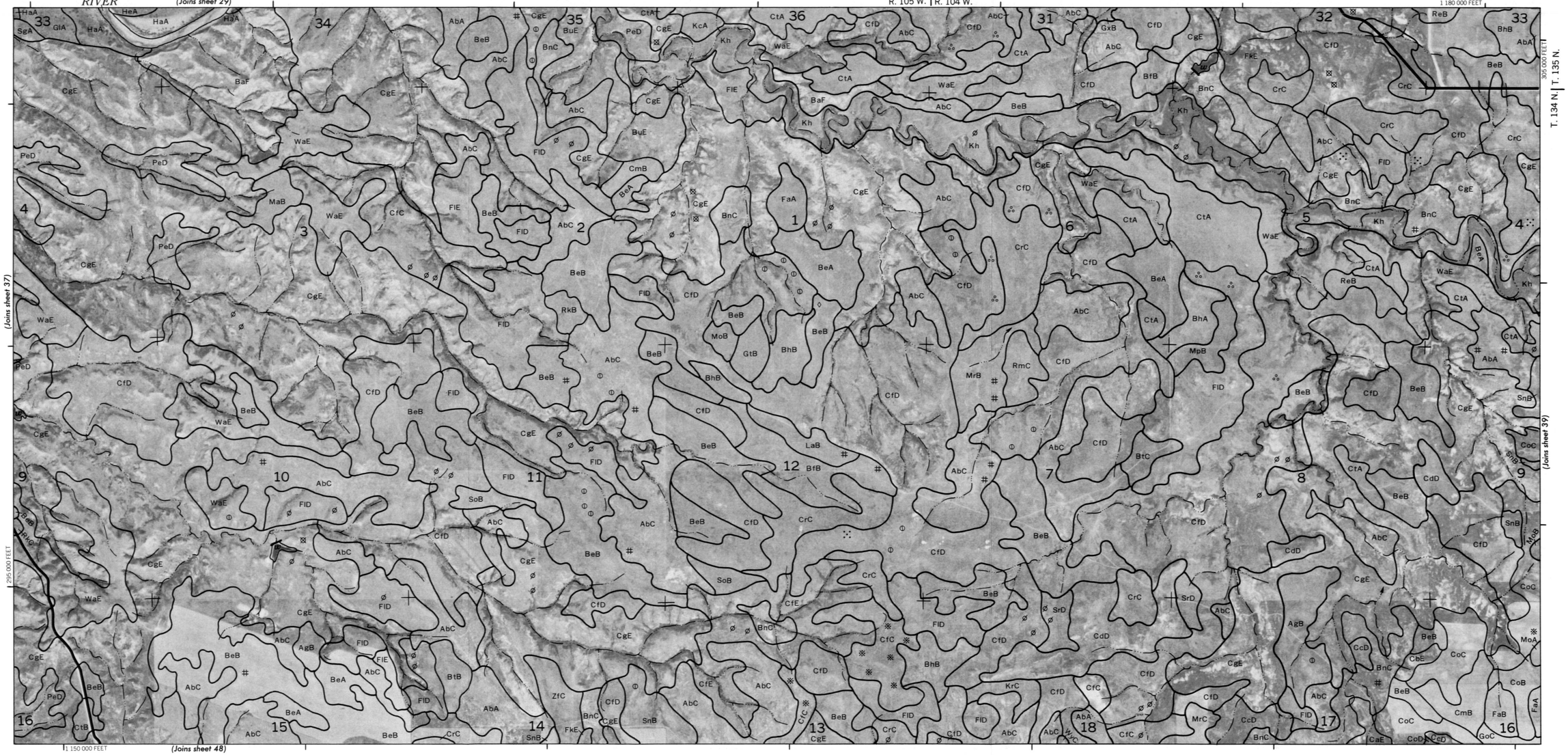


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1971 from 1970 trimetrogon aerial photographs obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 36

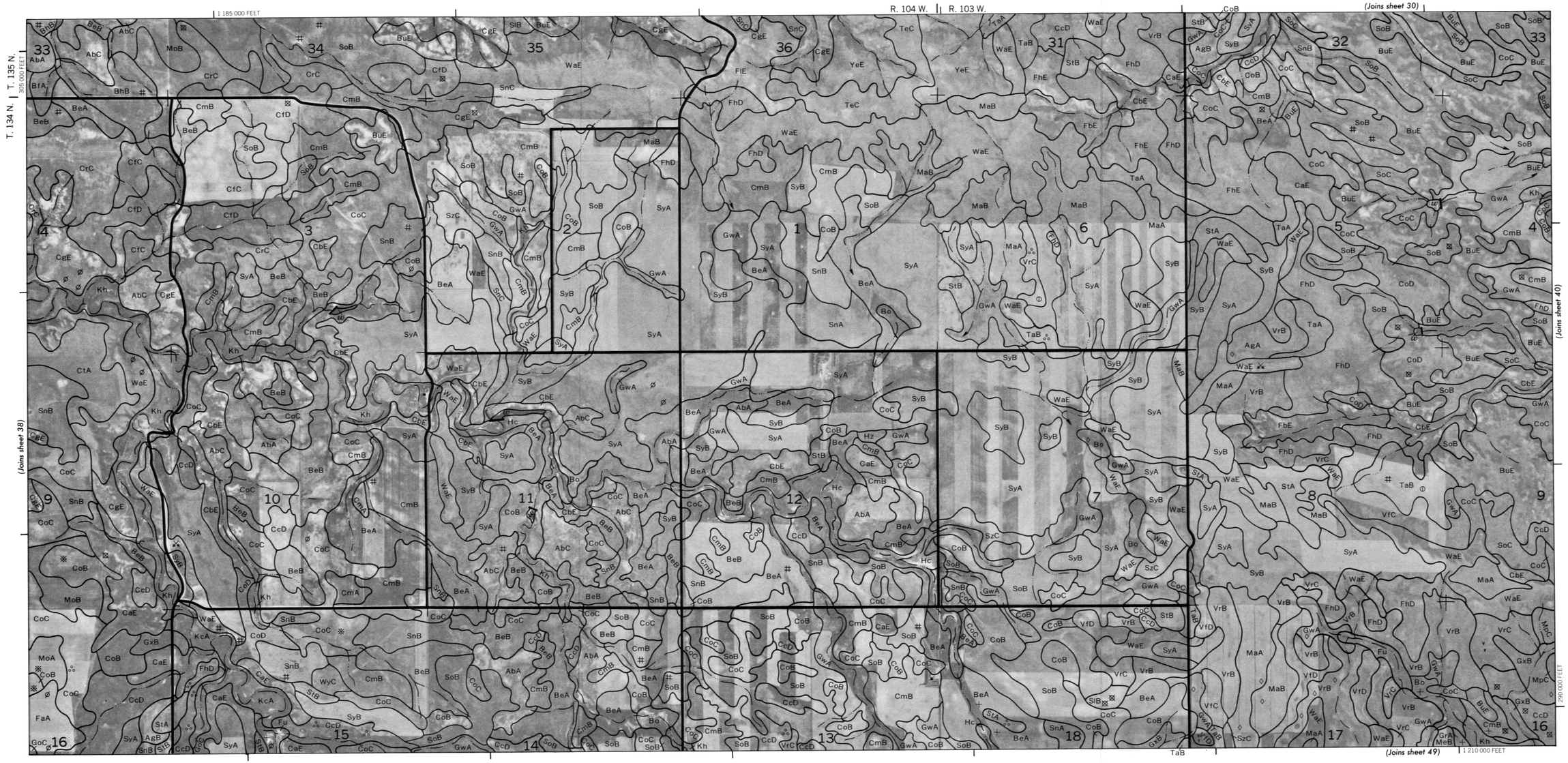
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 38

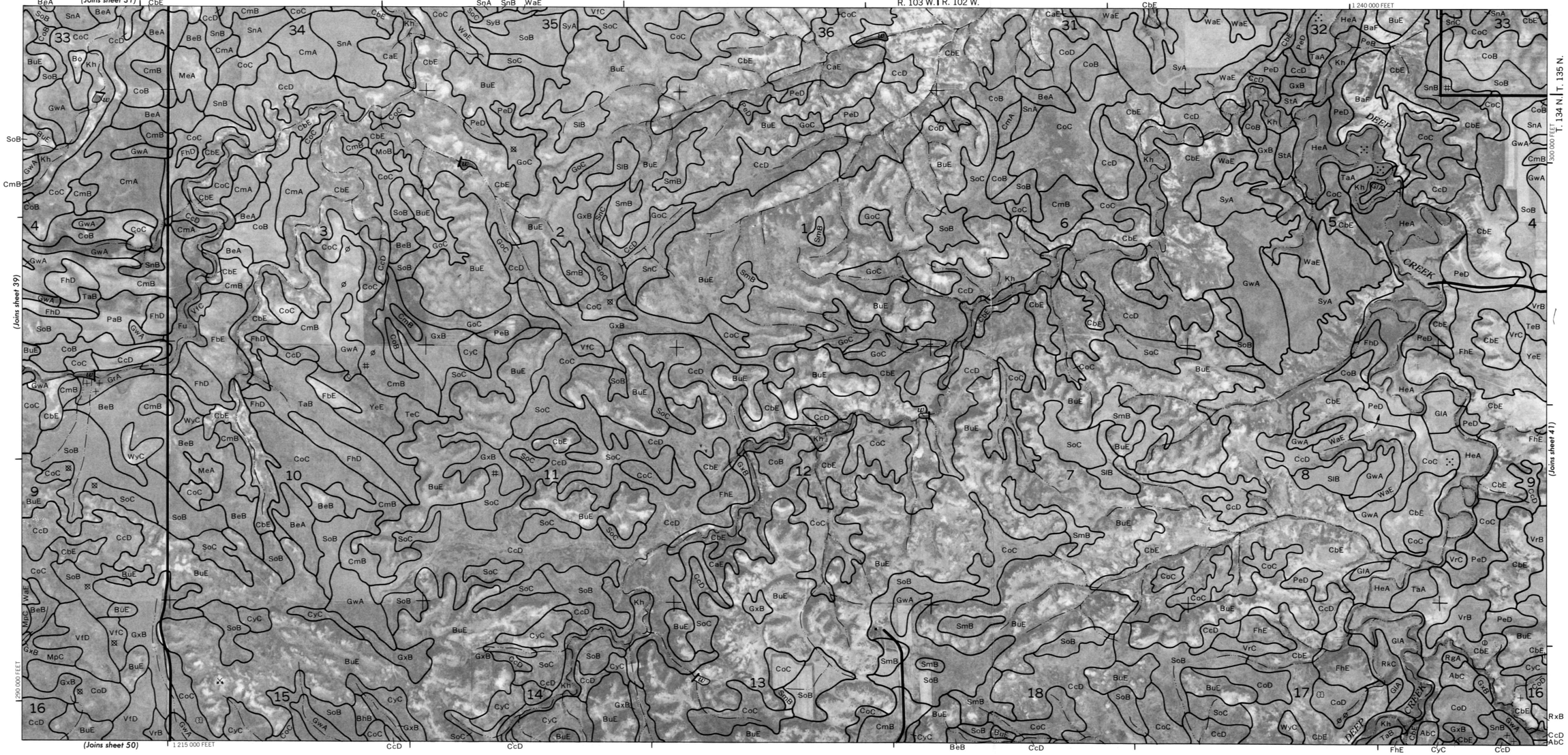


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1:24 000 orthophotography obtained from U. S. Department of the Interior, Geological Survey

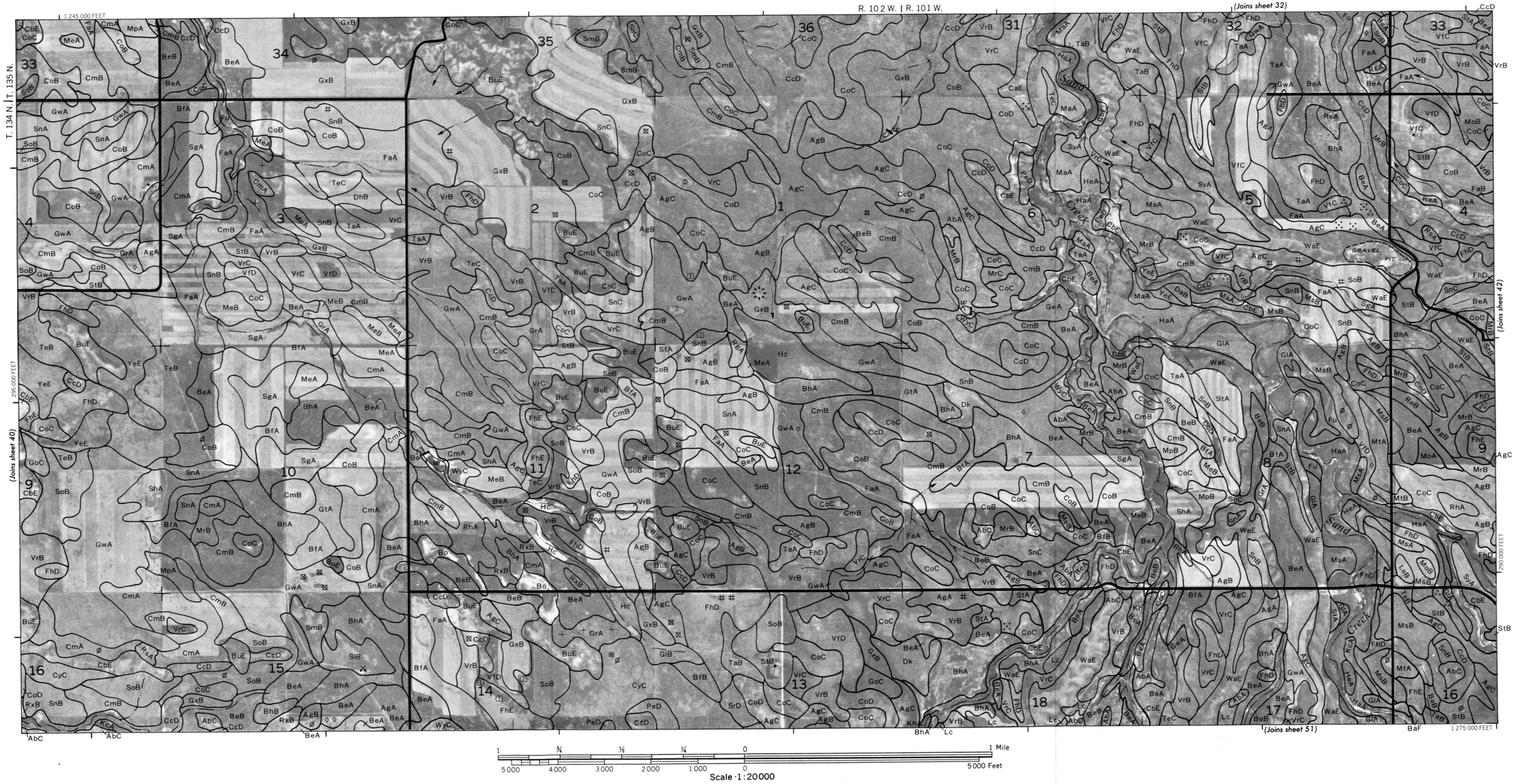
N



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.



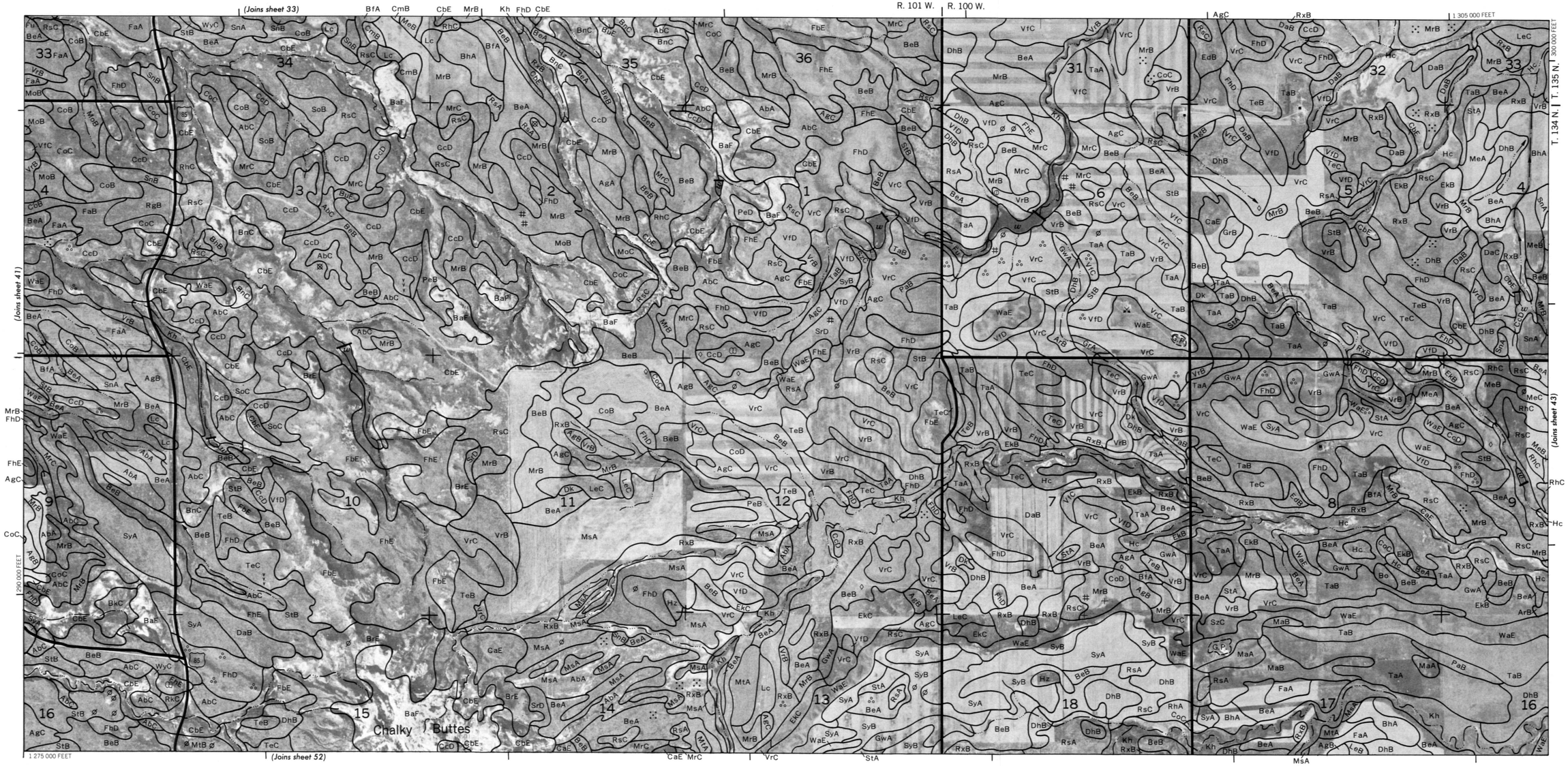
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 soil data simplified/partly obtained from U. S. Department of the Interior, Geological Survey.



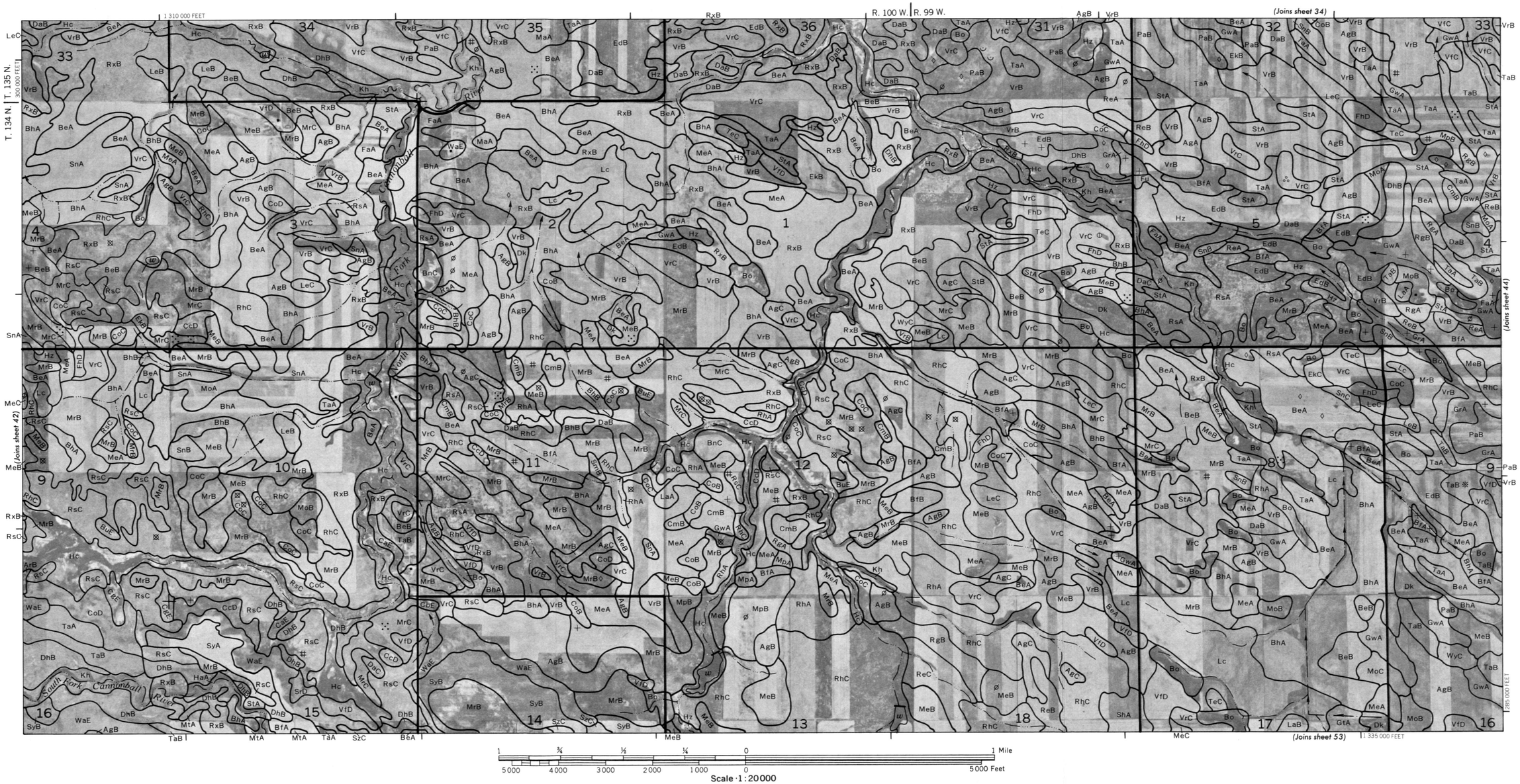
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 41

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 42

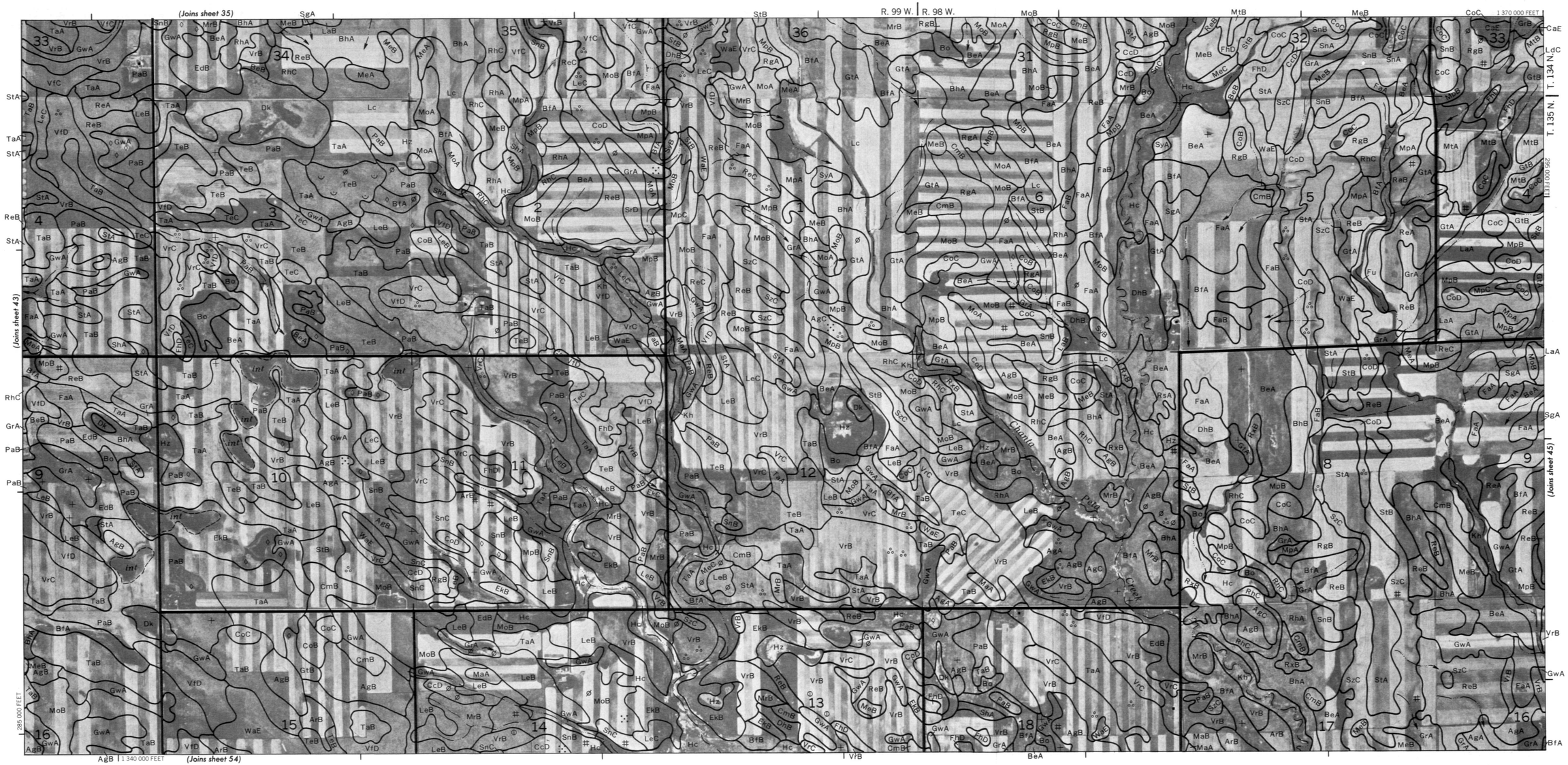


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1:24 000 scale topography obtained from U. S. Department of the Interior, Geological Survey.

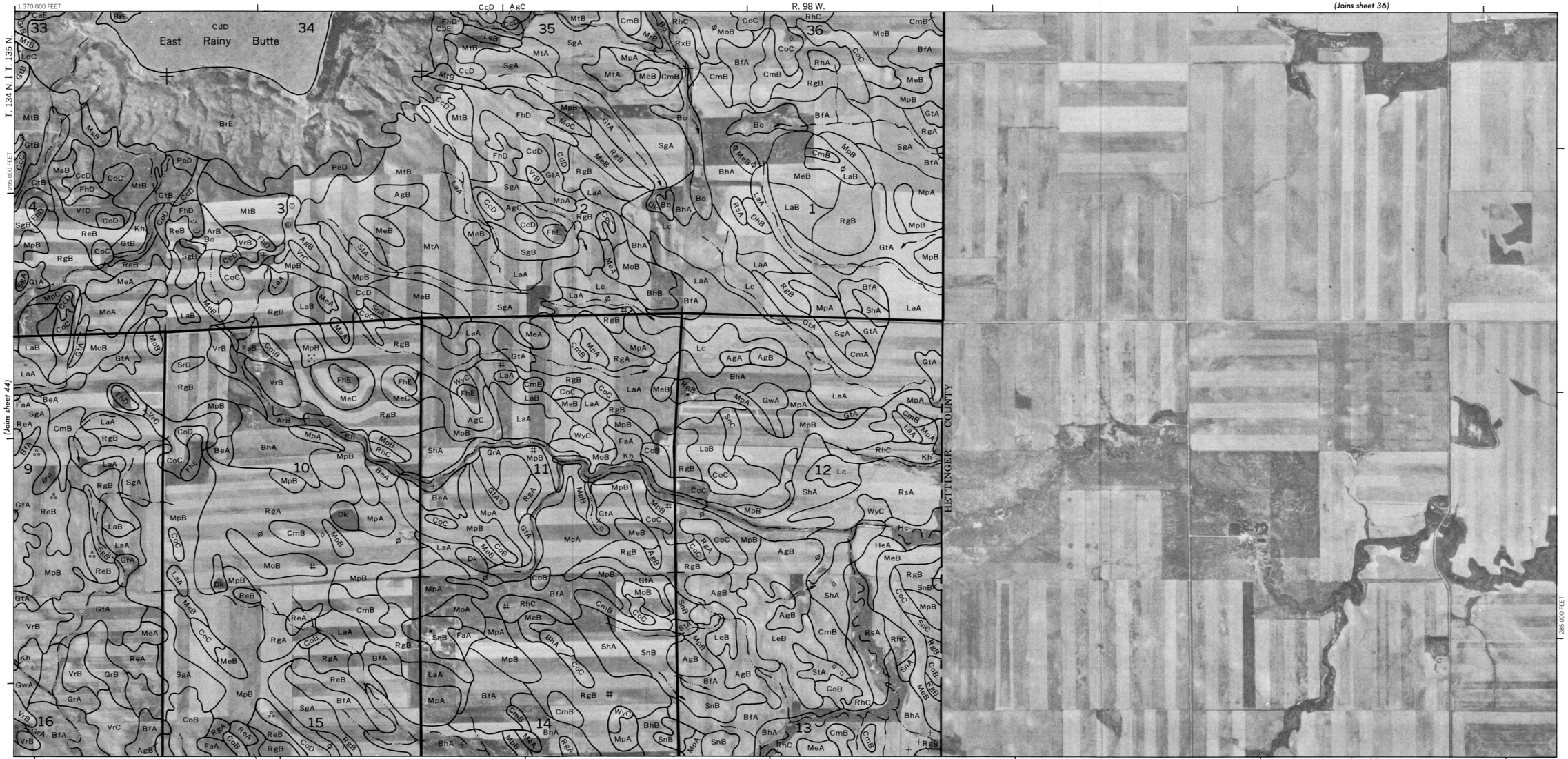


SLOPE COUNTY, NORTH DAKOTA NO. 43

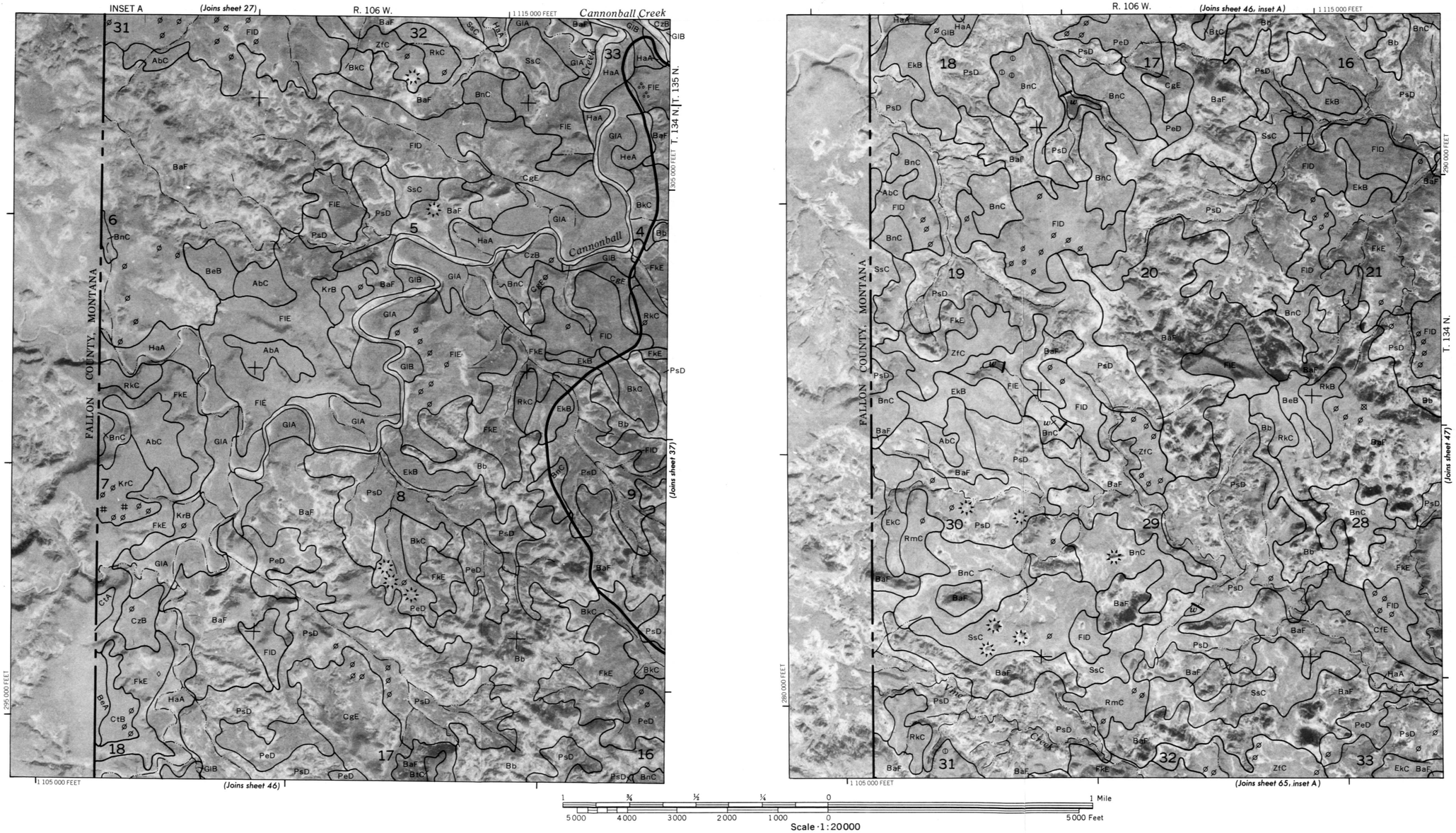
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 44



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.



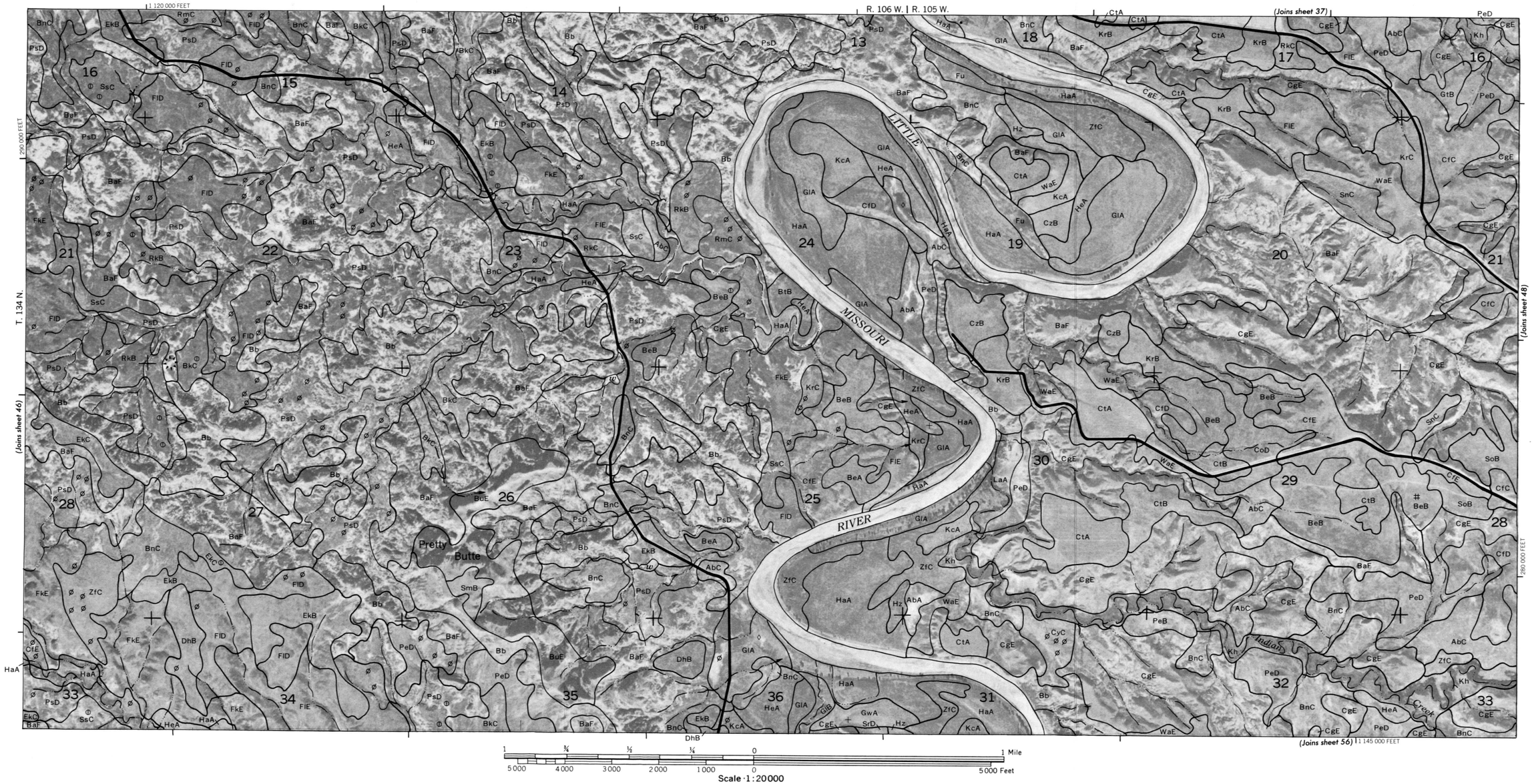
SLOPE COUNTY, NORTH DAKOTA NO. 45



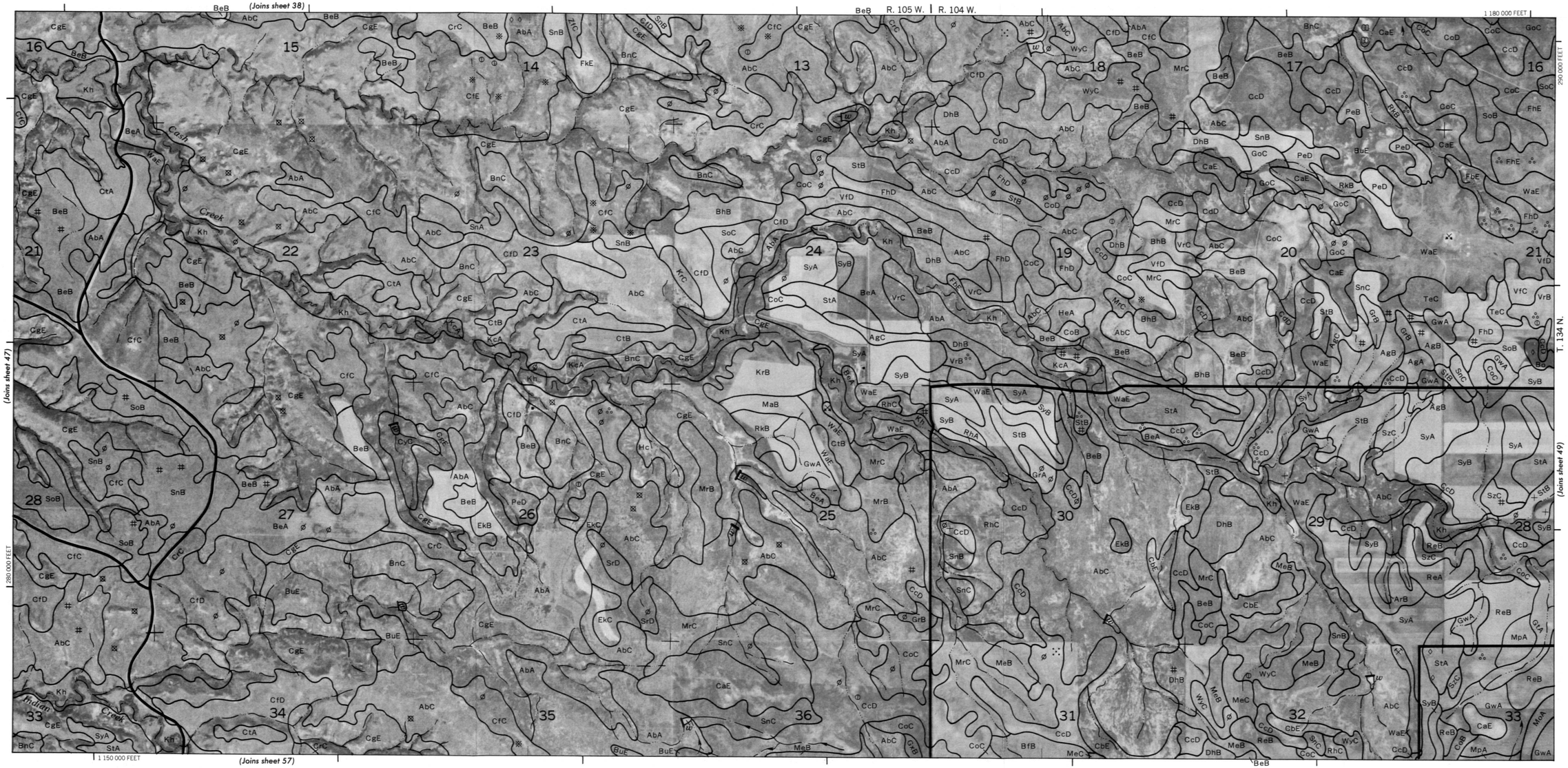
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 47

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey



SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 48



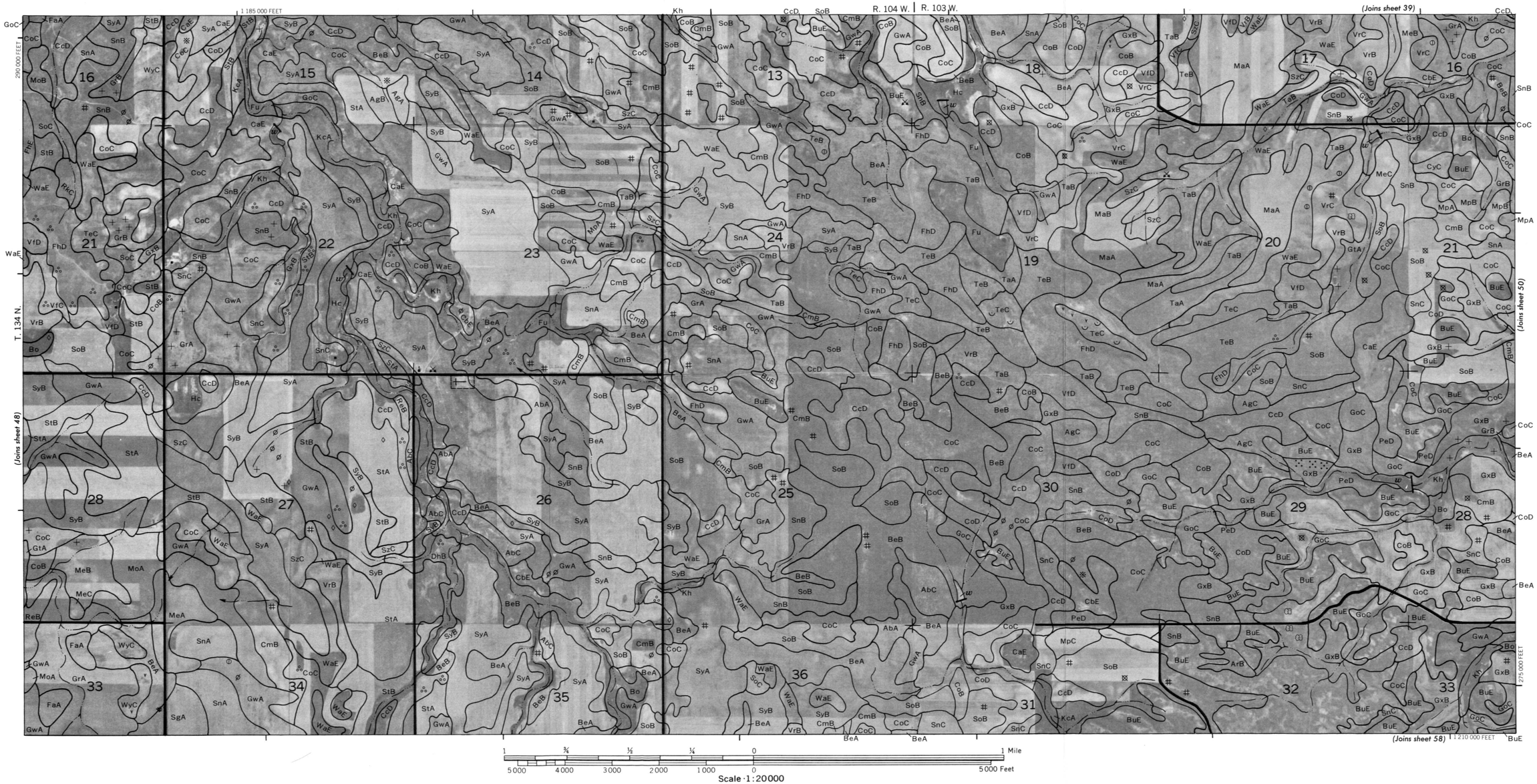
1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:20000

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 48



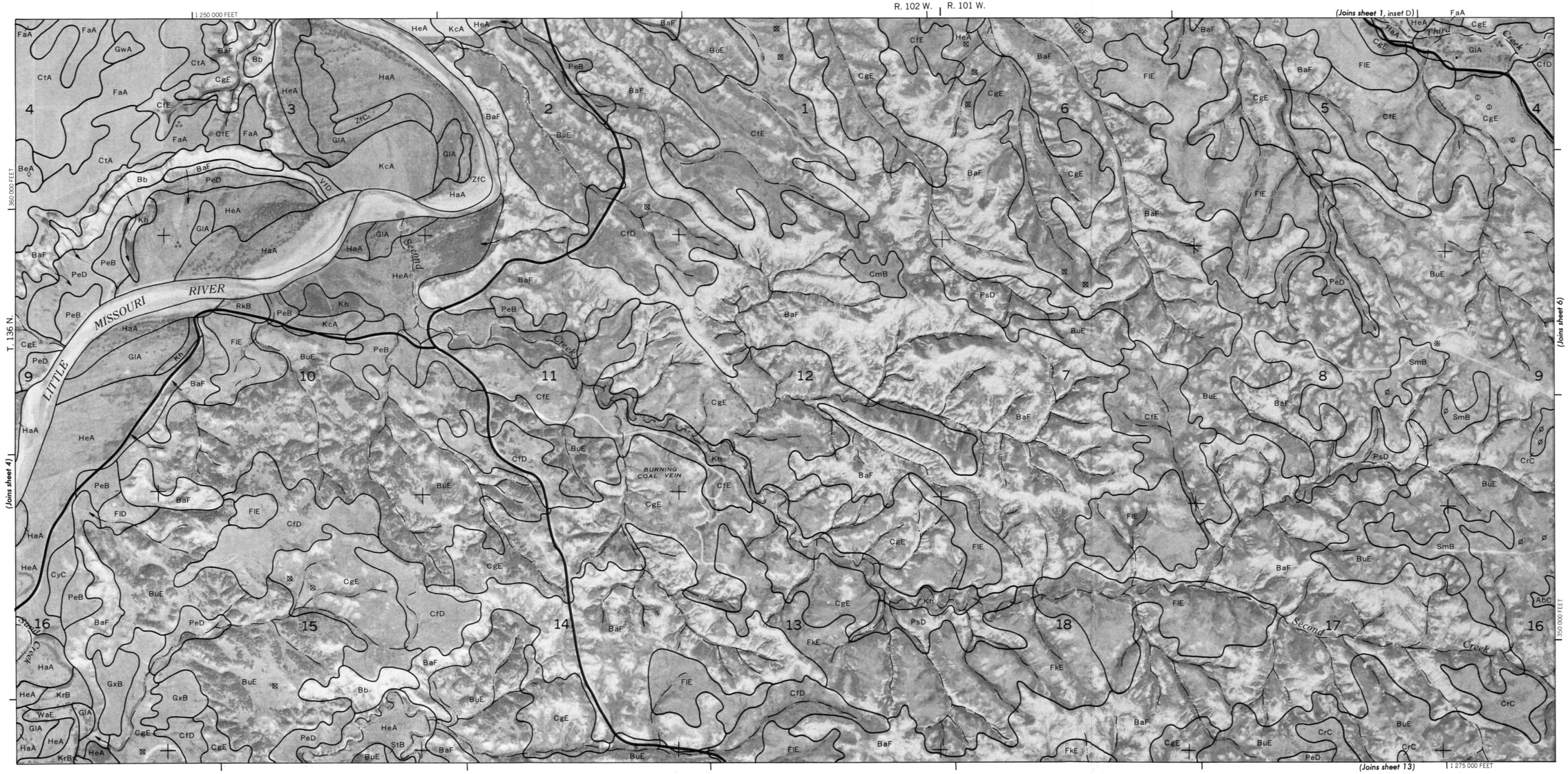
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 49

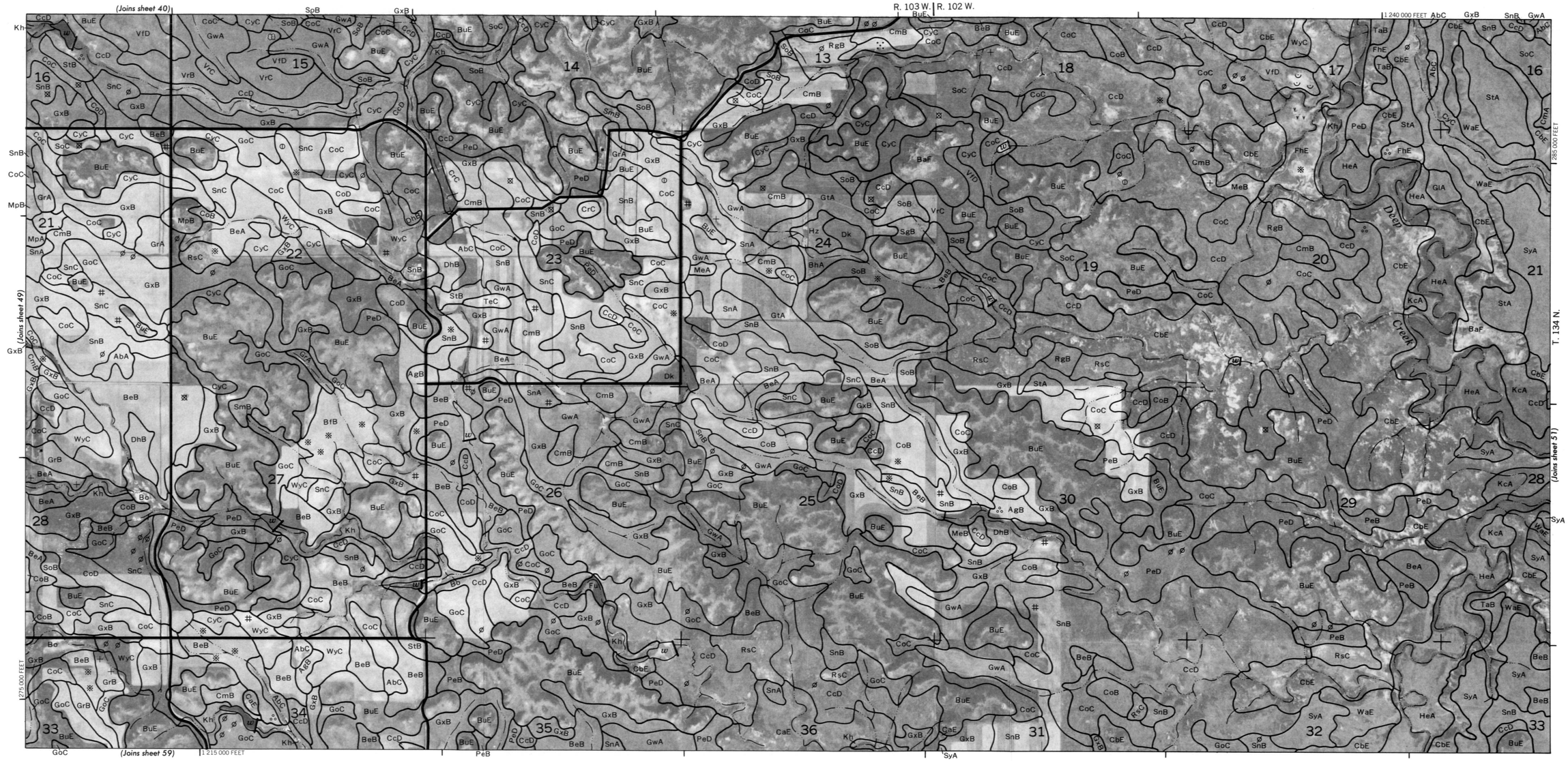
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 5

SLOPE COUNTY, NORTH DAKOTA NO. 5

This was compiled by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

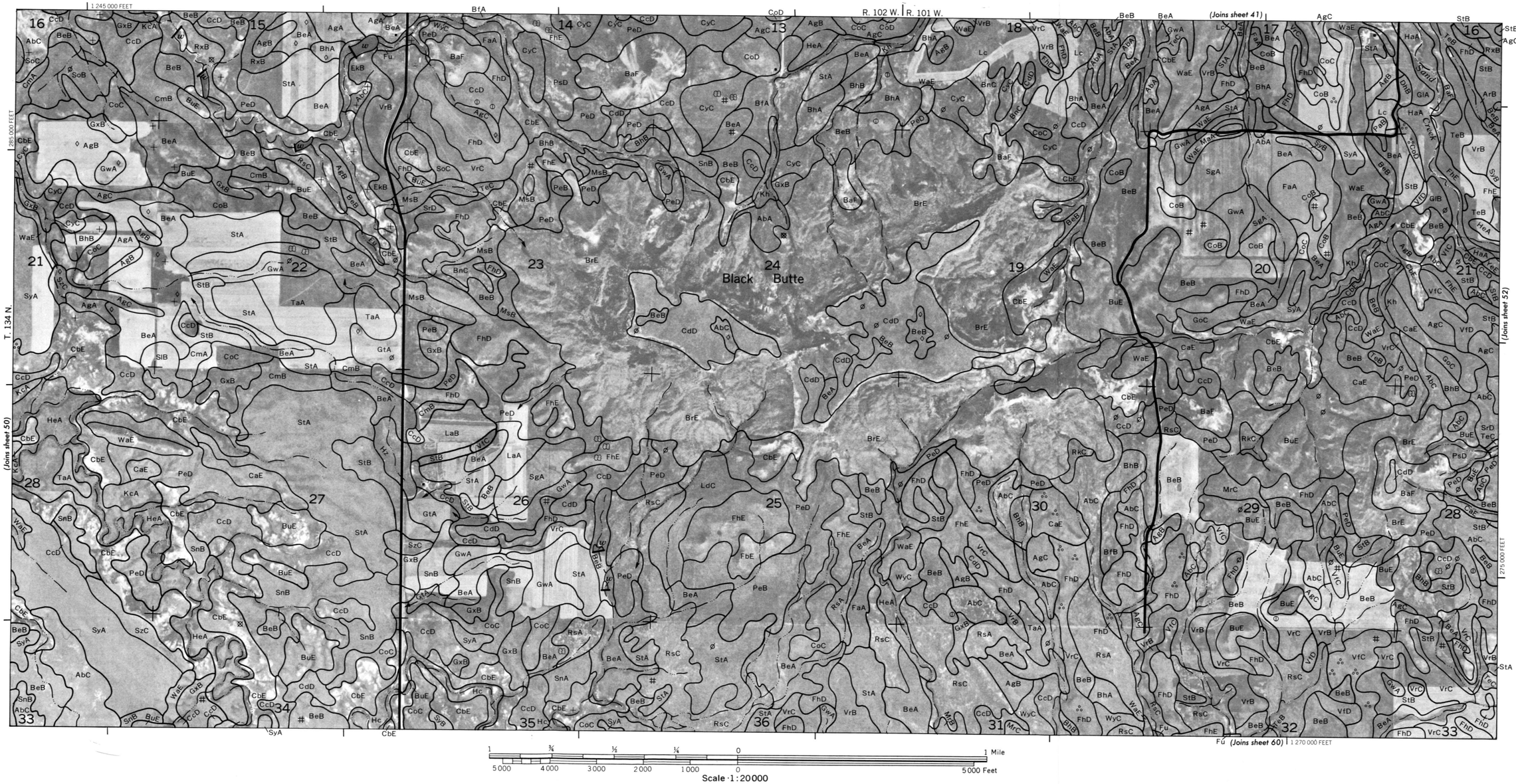


SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 50



This map was compiled by U. S. Department of Agriculture Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 50



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

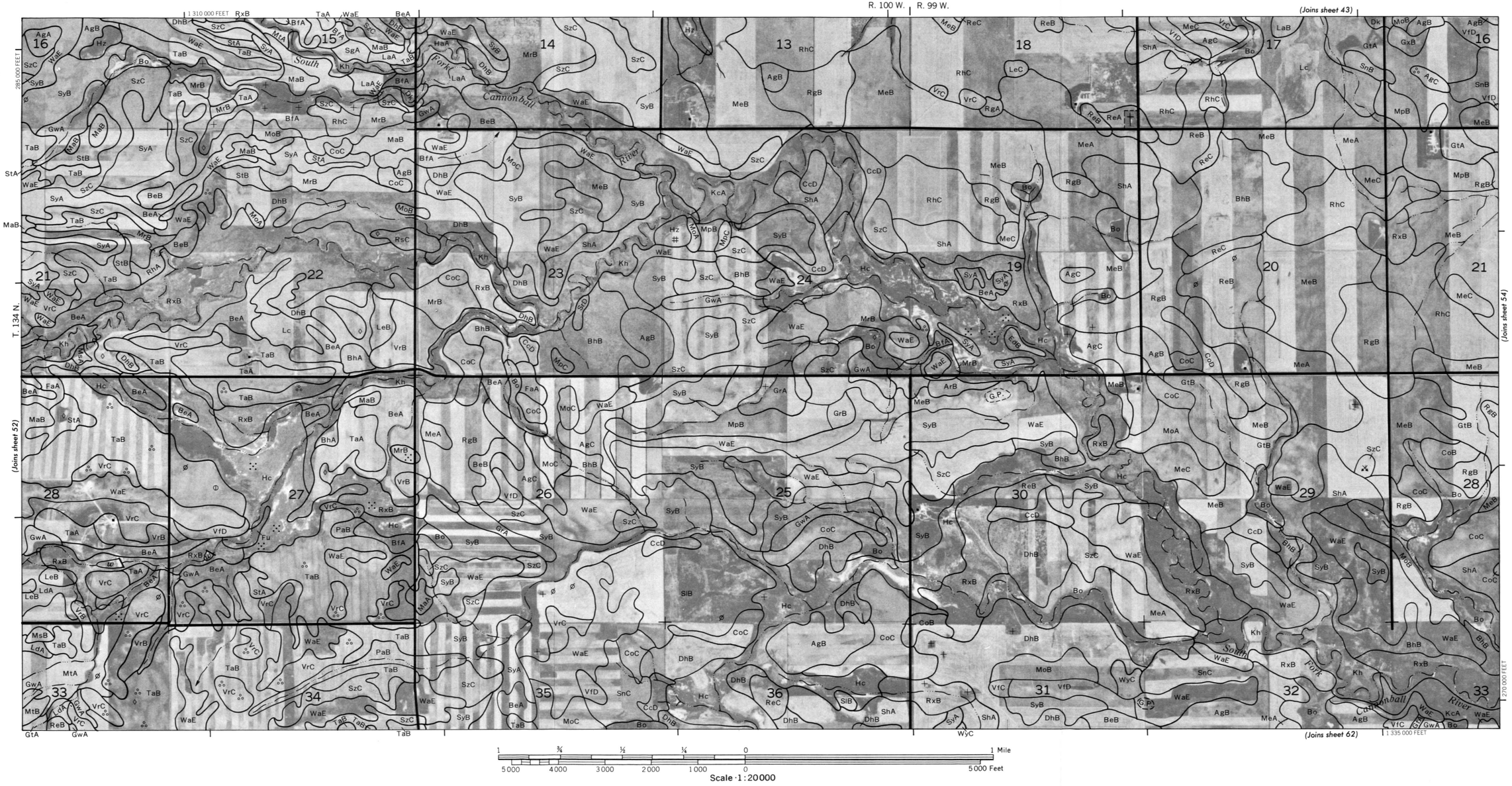
SLOPE COUNTY, NORTH DAKOTA NO. 51

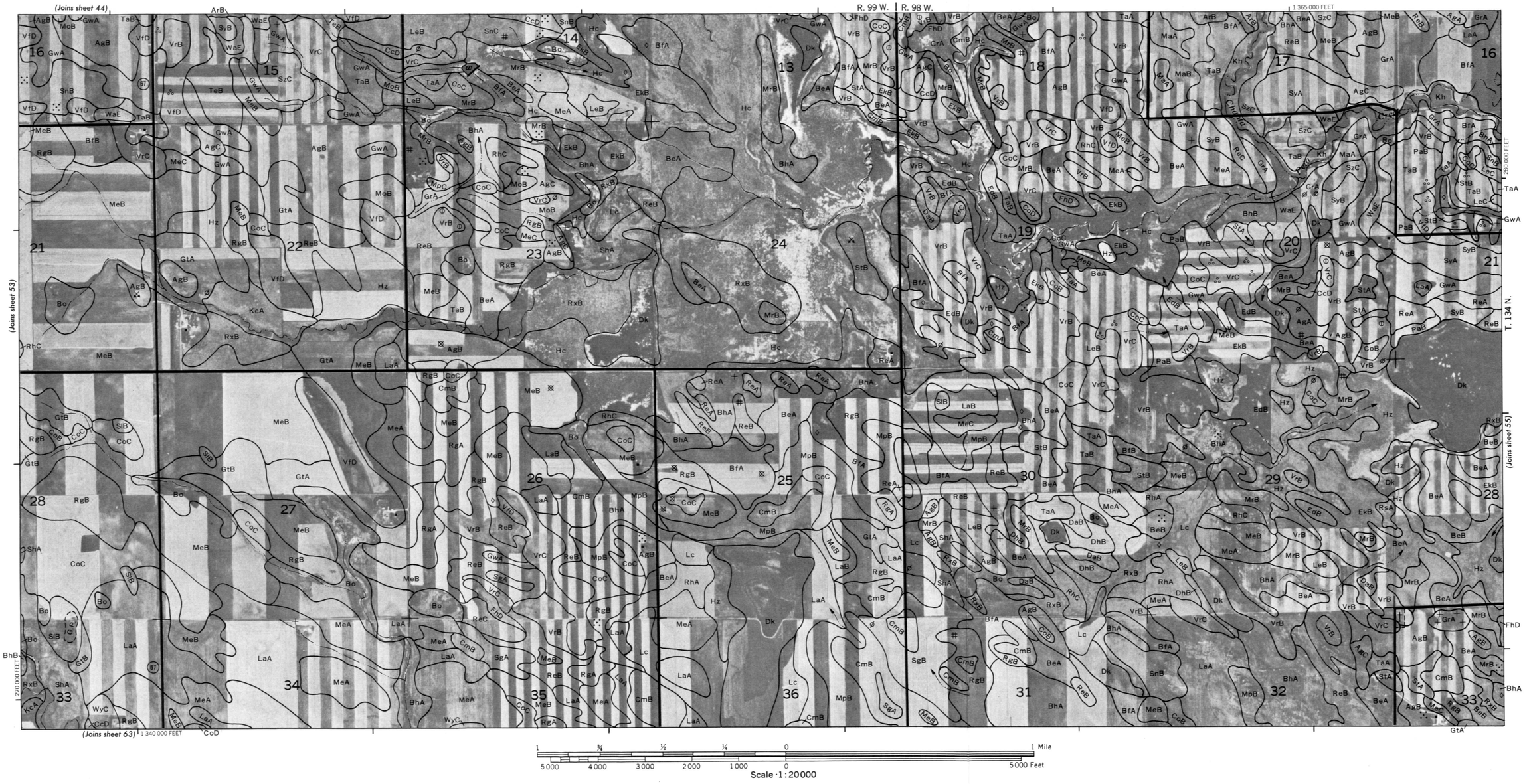
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 52

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

SLOPE COUNTY, NORTH DAKOTA NO. 53

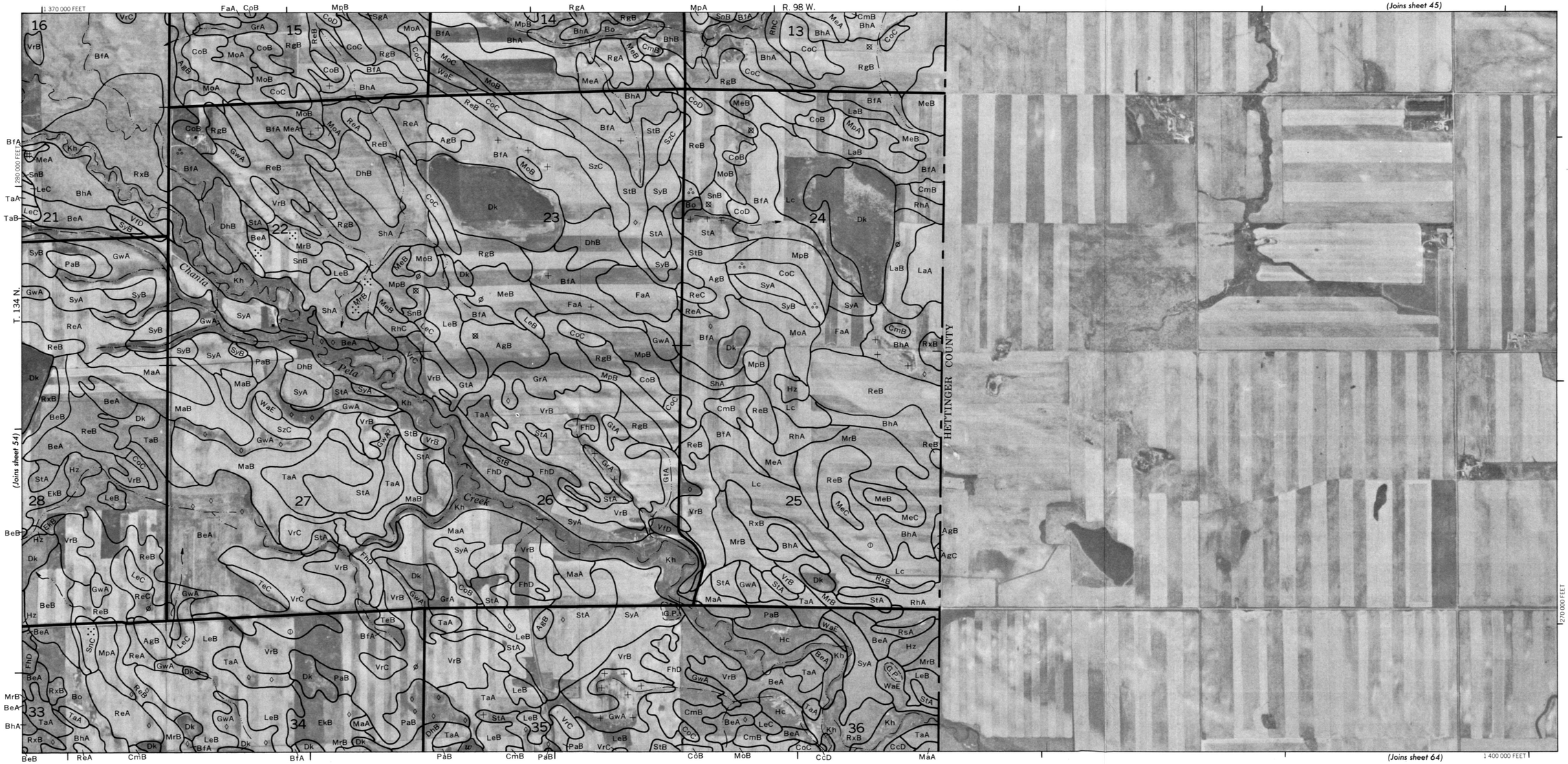
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1976 orthophotography obtained from U. S. Department of the Interior, Geological Survey.





This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

N



1 ¾ ½ ¼ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

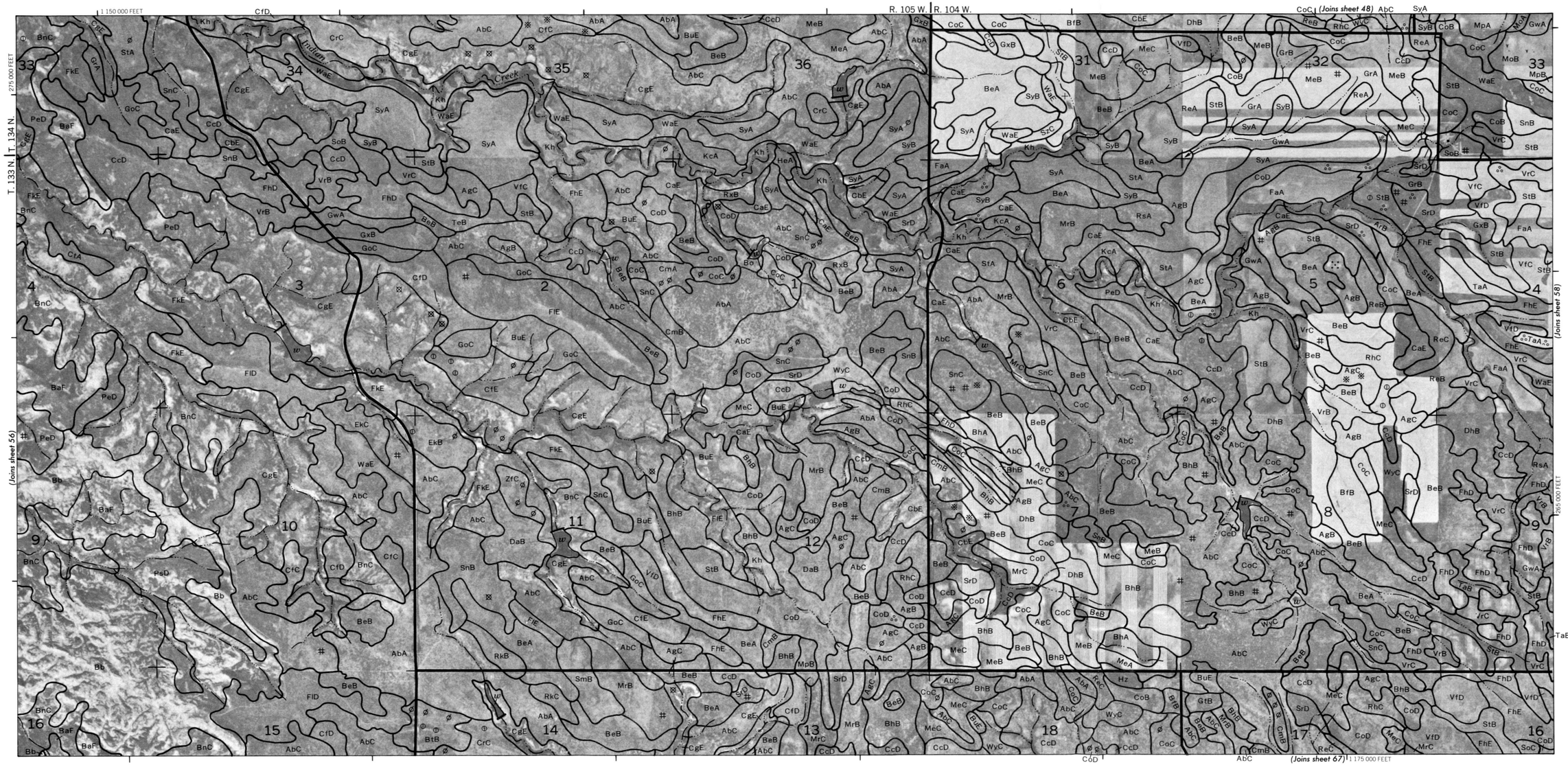
Scale 1:20000

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

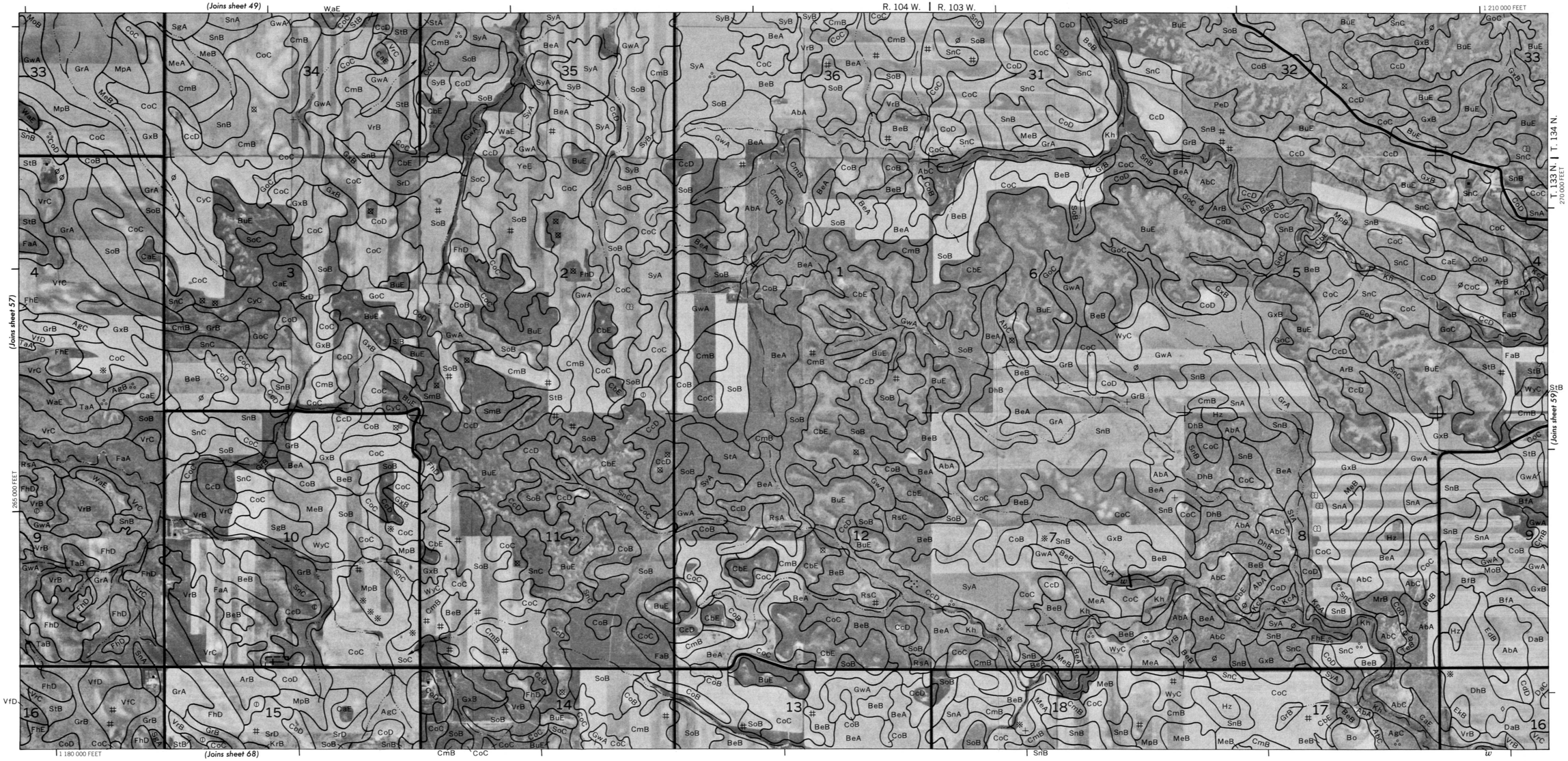
SLOPE COUNTY, NORTH DAKOTA NO. 55

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

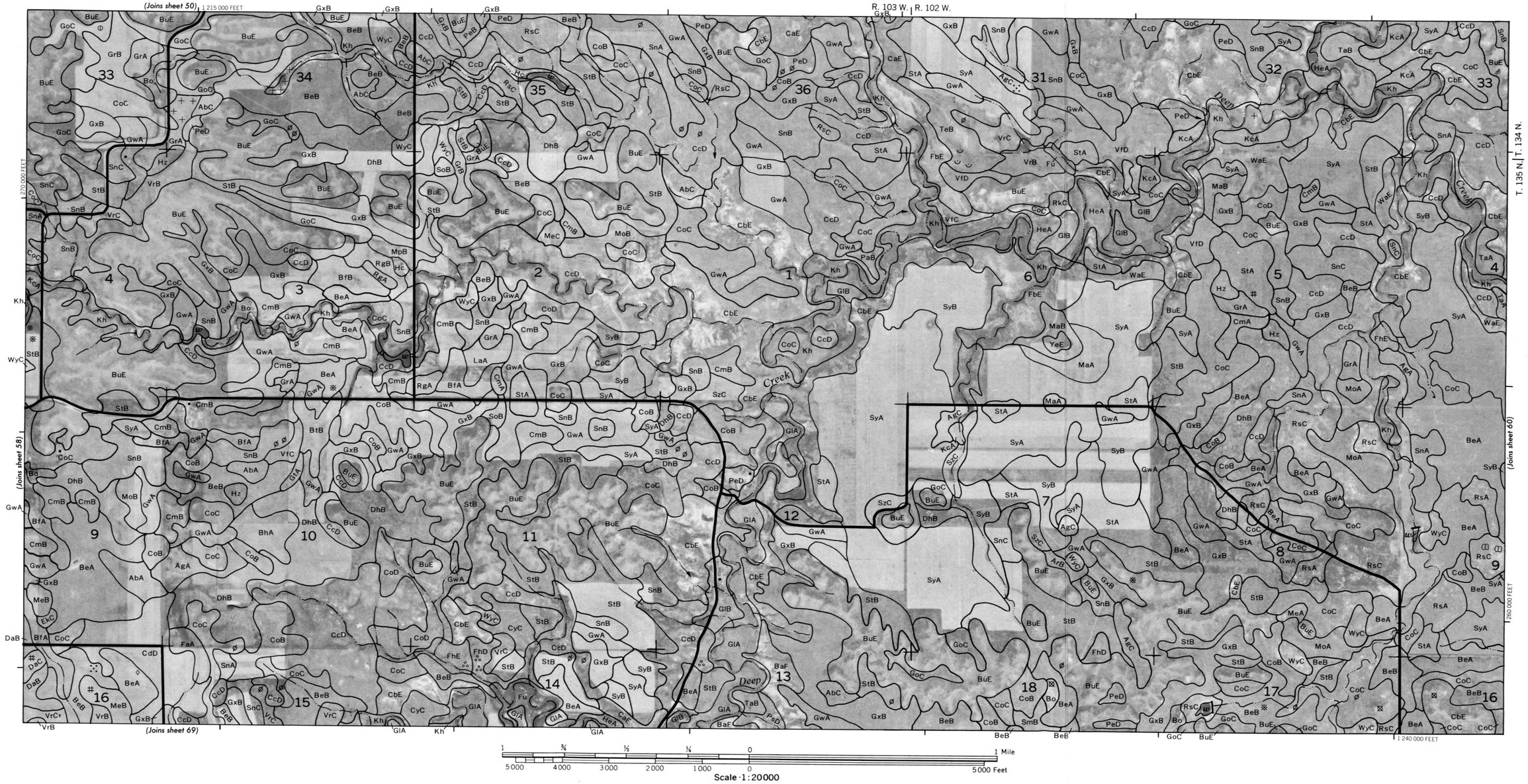
This map was compiled by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 photography obtained by the U. S. Department of the Interior, Geological Survey.



SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 58



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 photomosaic obtained from U. S. Department of the Interior, Geological Survey



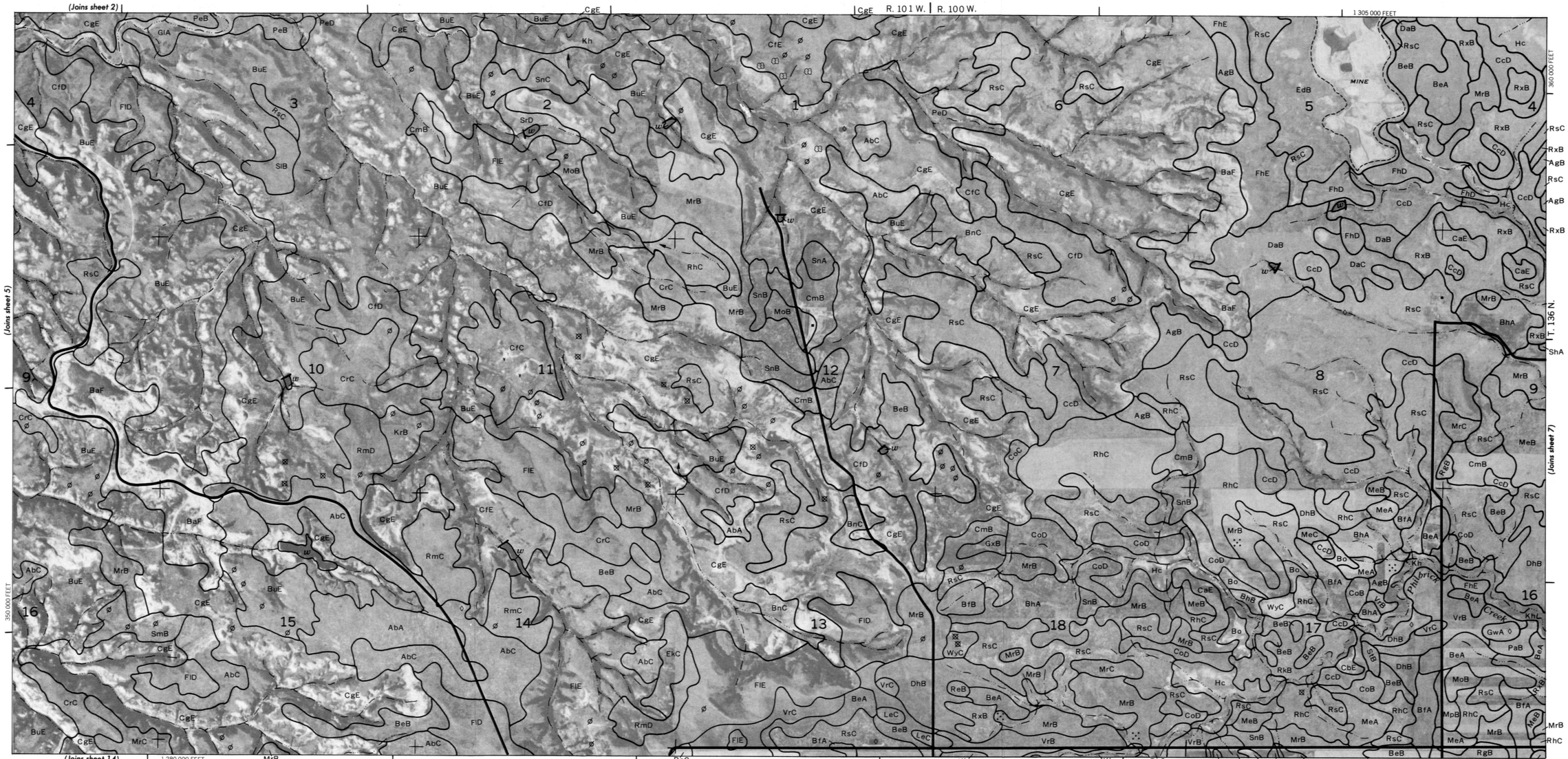
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

SLOPE COUNTY, NORTH DAKOTA NO. 59

6

N

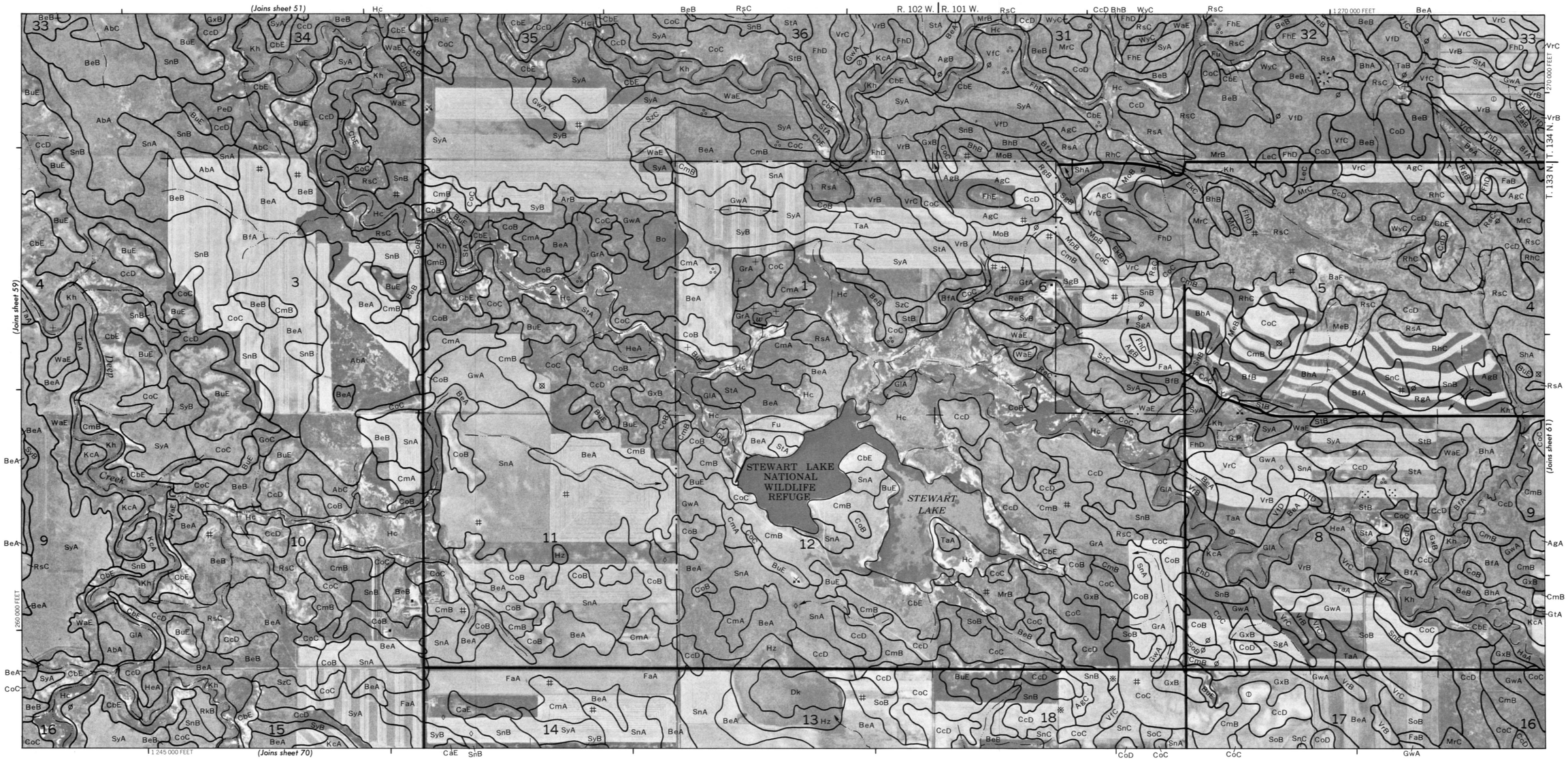
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 6



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

SLOPE COUNTY, NORTH DAKOTA NO. 6

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 60



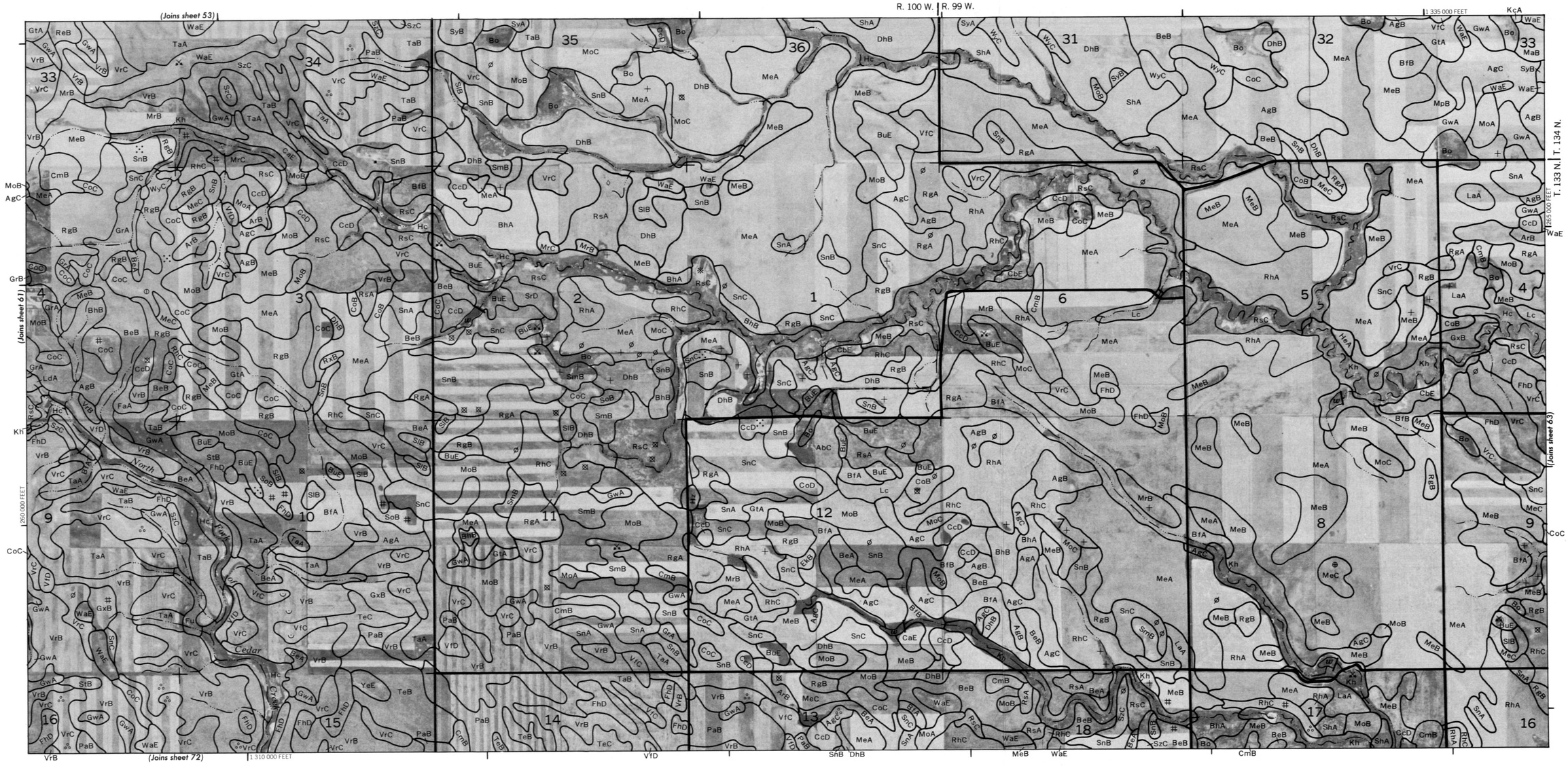
This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

SLOPE COUNTY, NORTH DAKOTA NO. 61

62

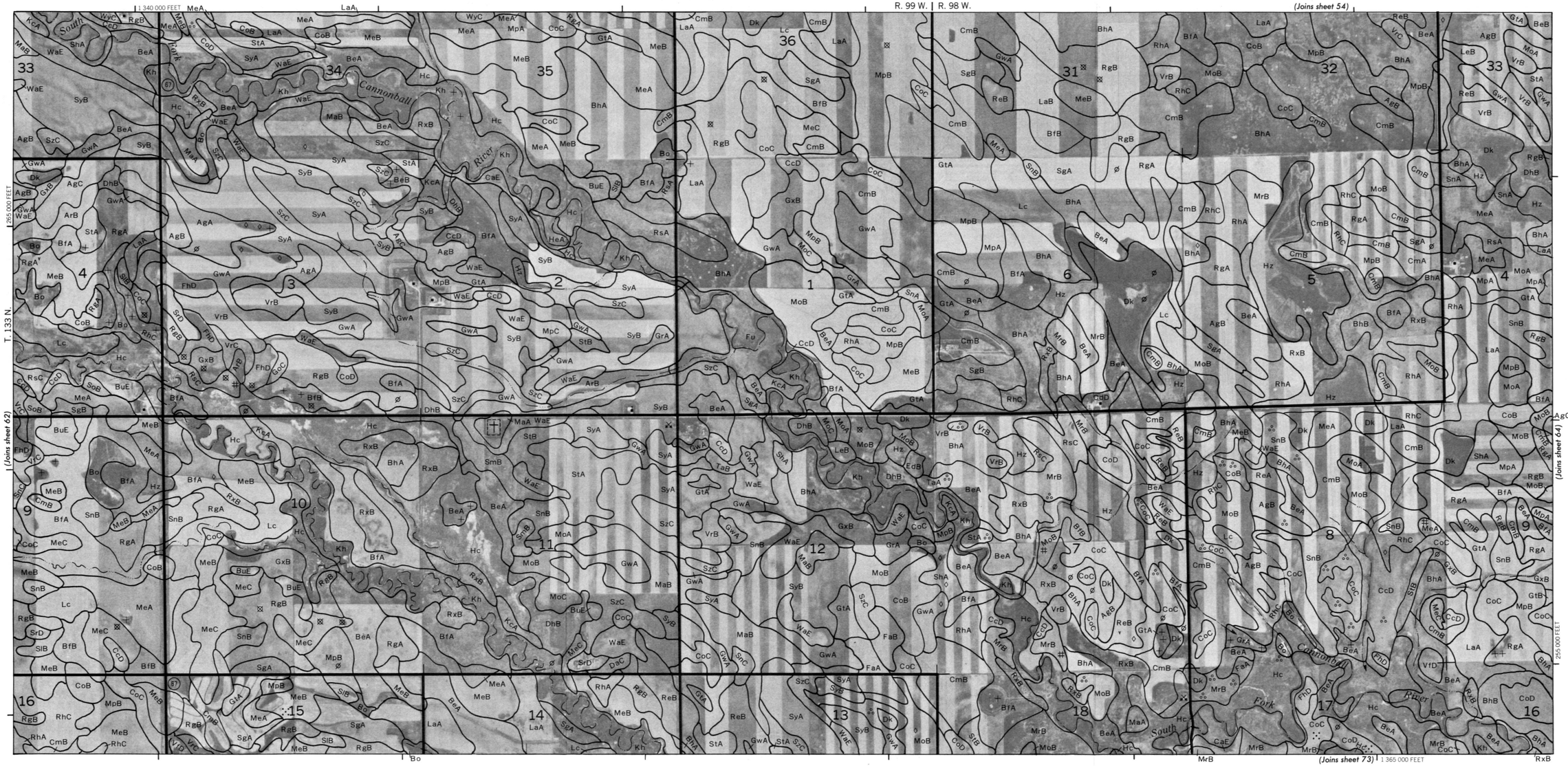
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 62



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 photomosaic obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 62

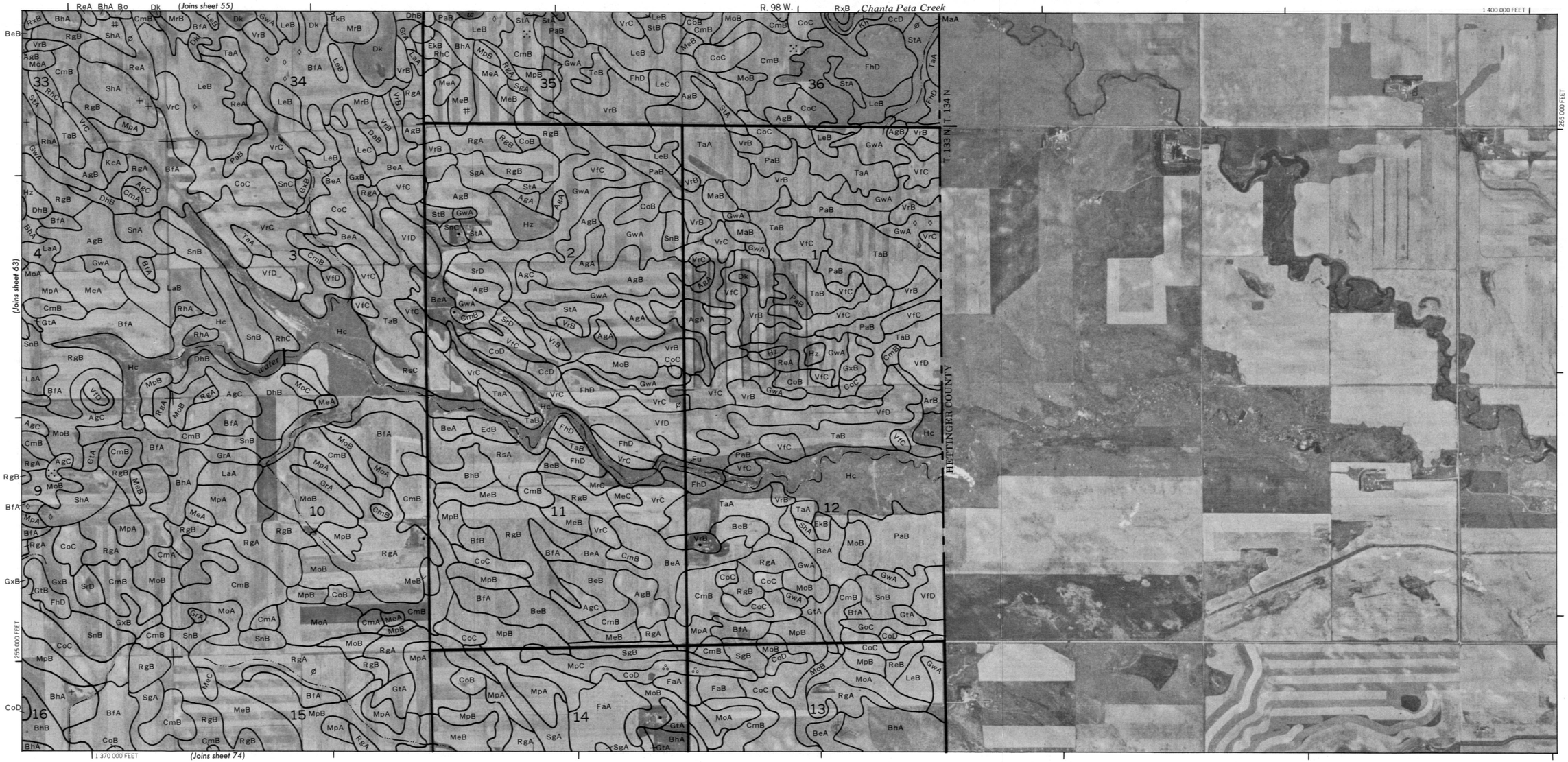
N



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior - Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 63

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 64



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey

N

SLOPE COUNTY, NORTH DAKOTA NO. 65

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 66

1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

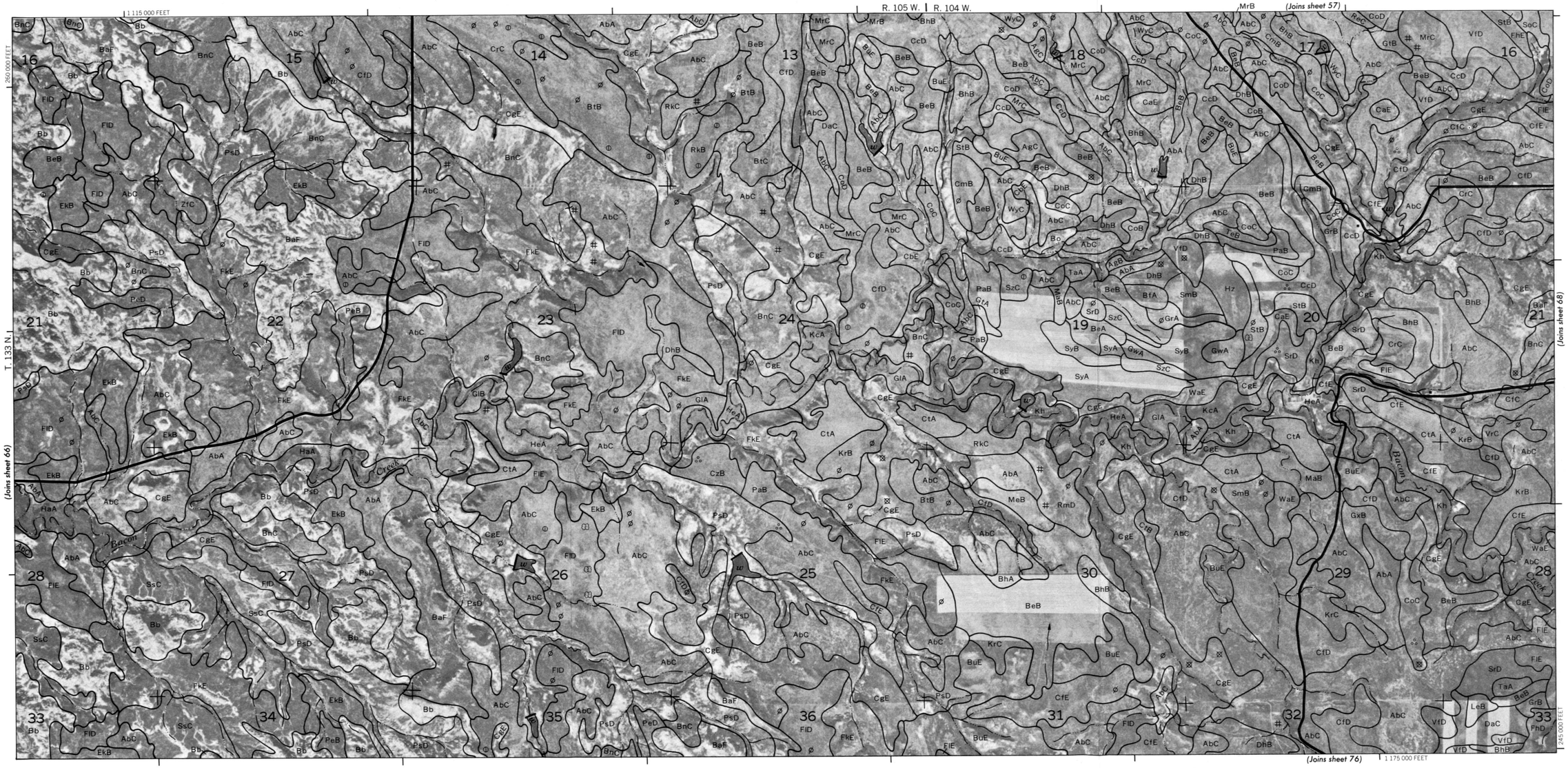
Scale · 1 : 20000

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 67

67

N



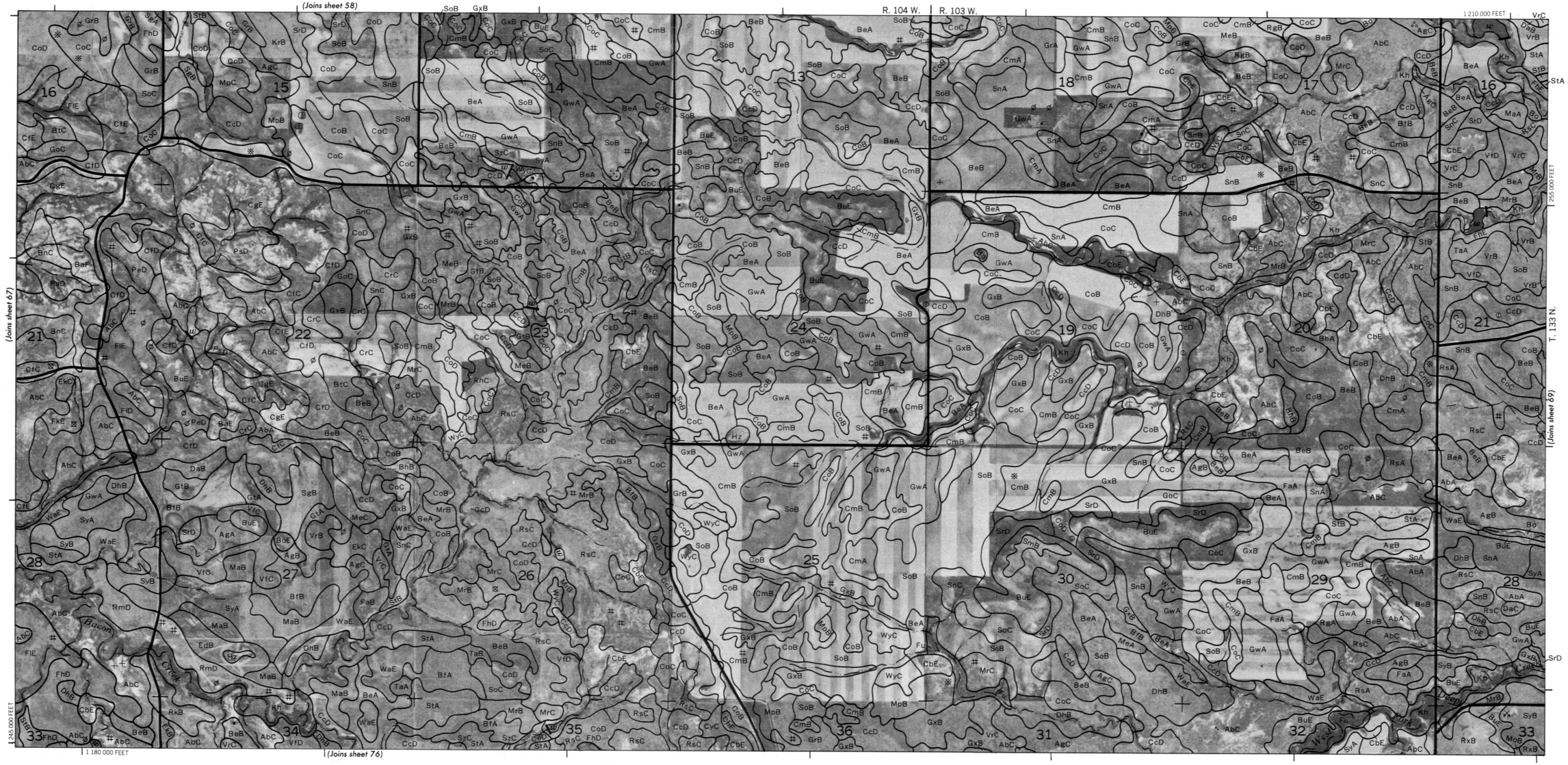
SLOPE COUNTY, NORTH DAKOTA NO. 67

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

(68)

N

SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 68



1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

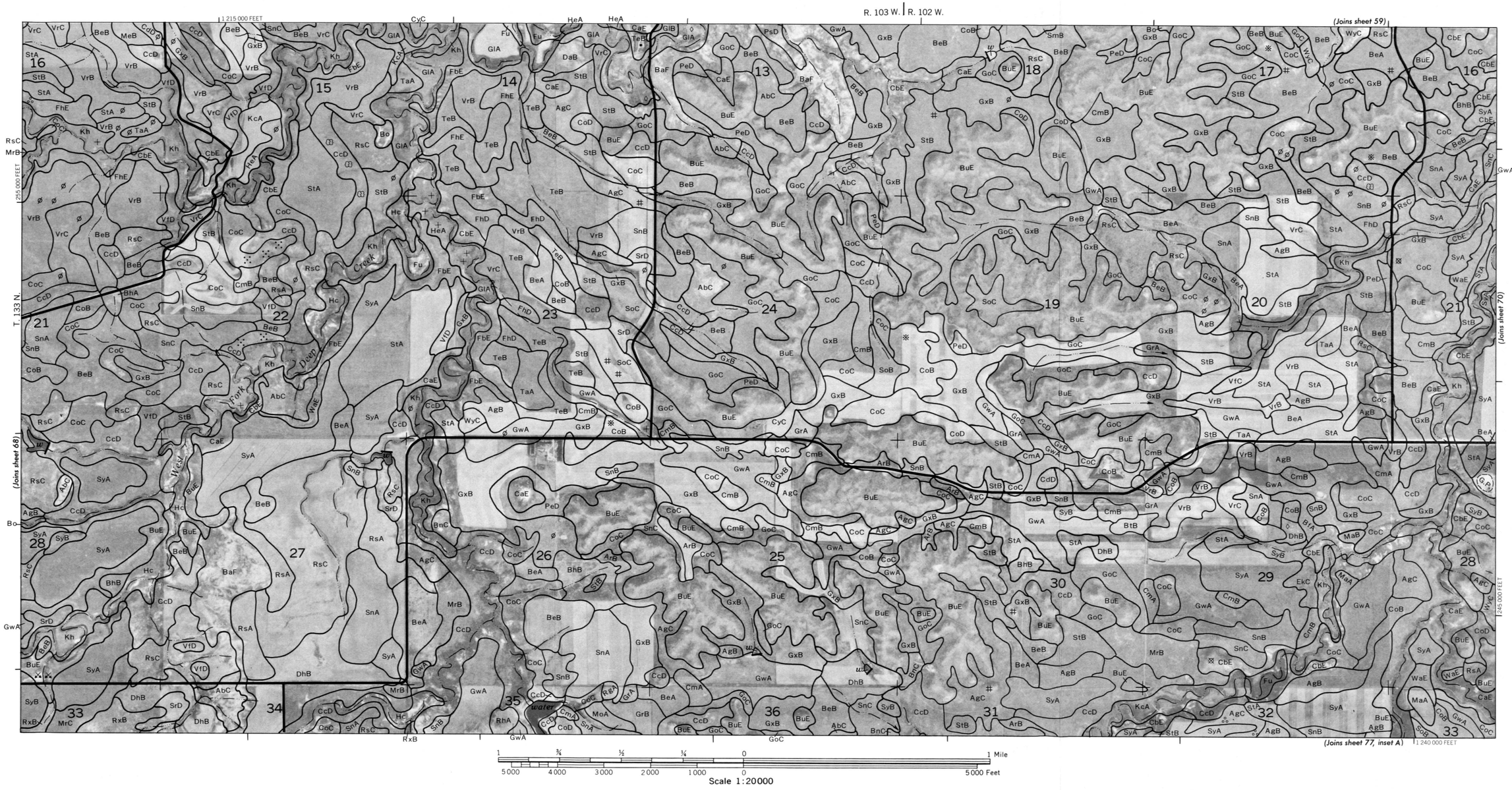
Scale 1:20000

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 68

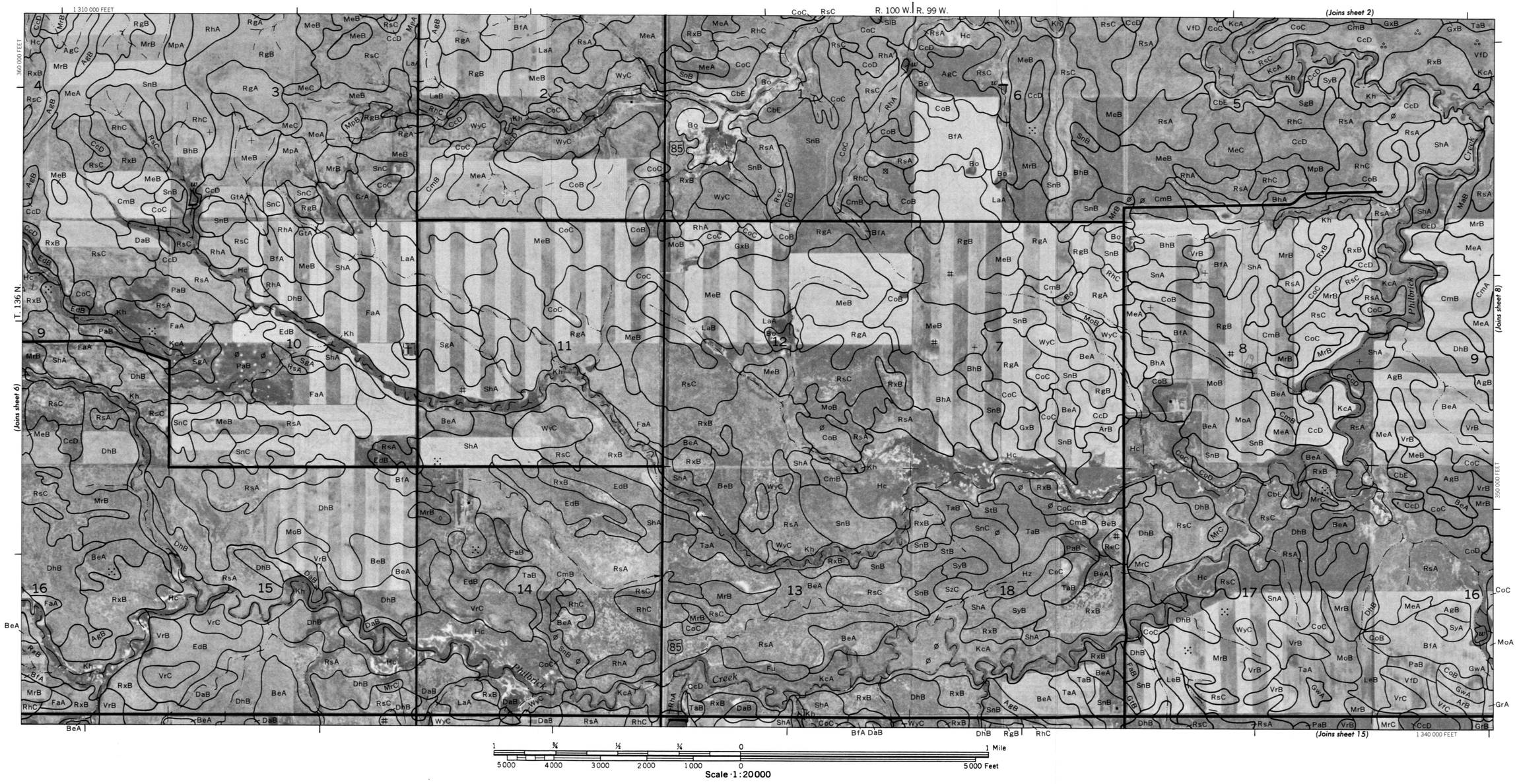
SLOPE COUNTY, NORTH DAKOTA NO. 69

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

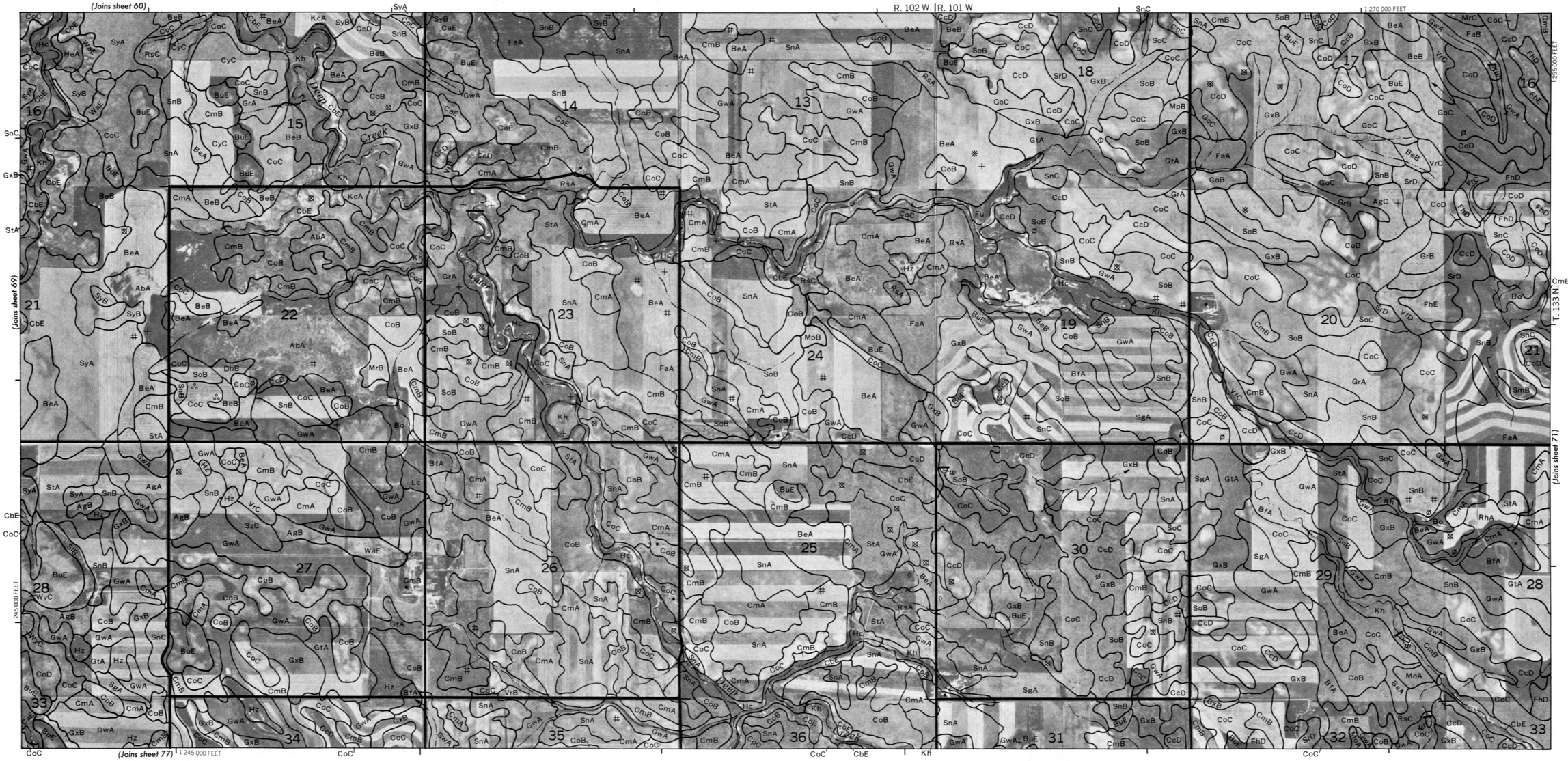


SLOPE COUNTY, NORTH DAKOTA NO. 7

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

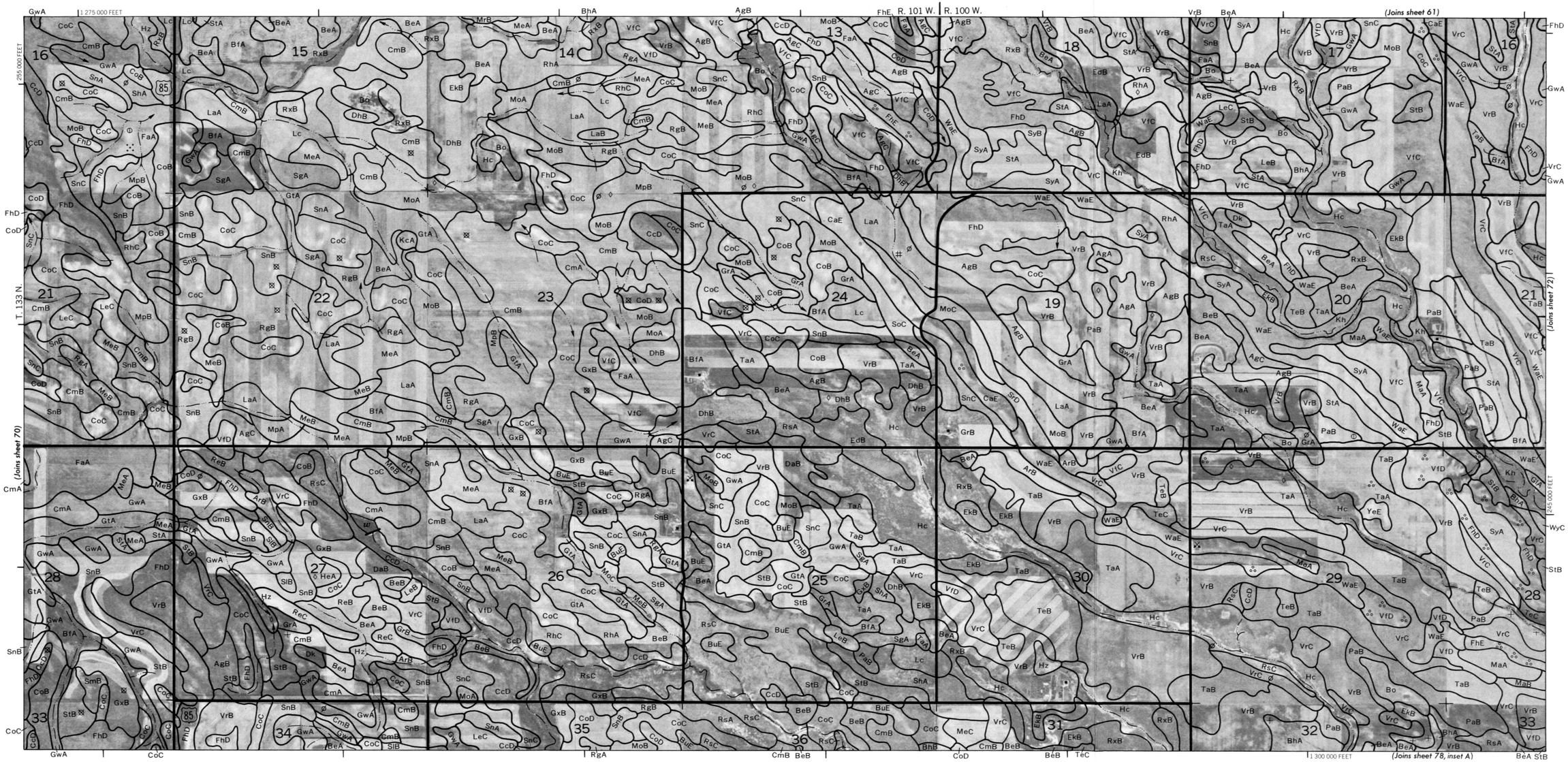


SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 70

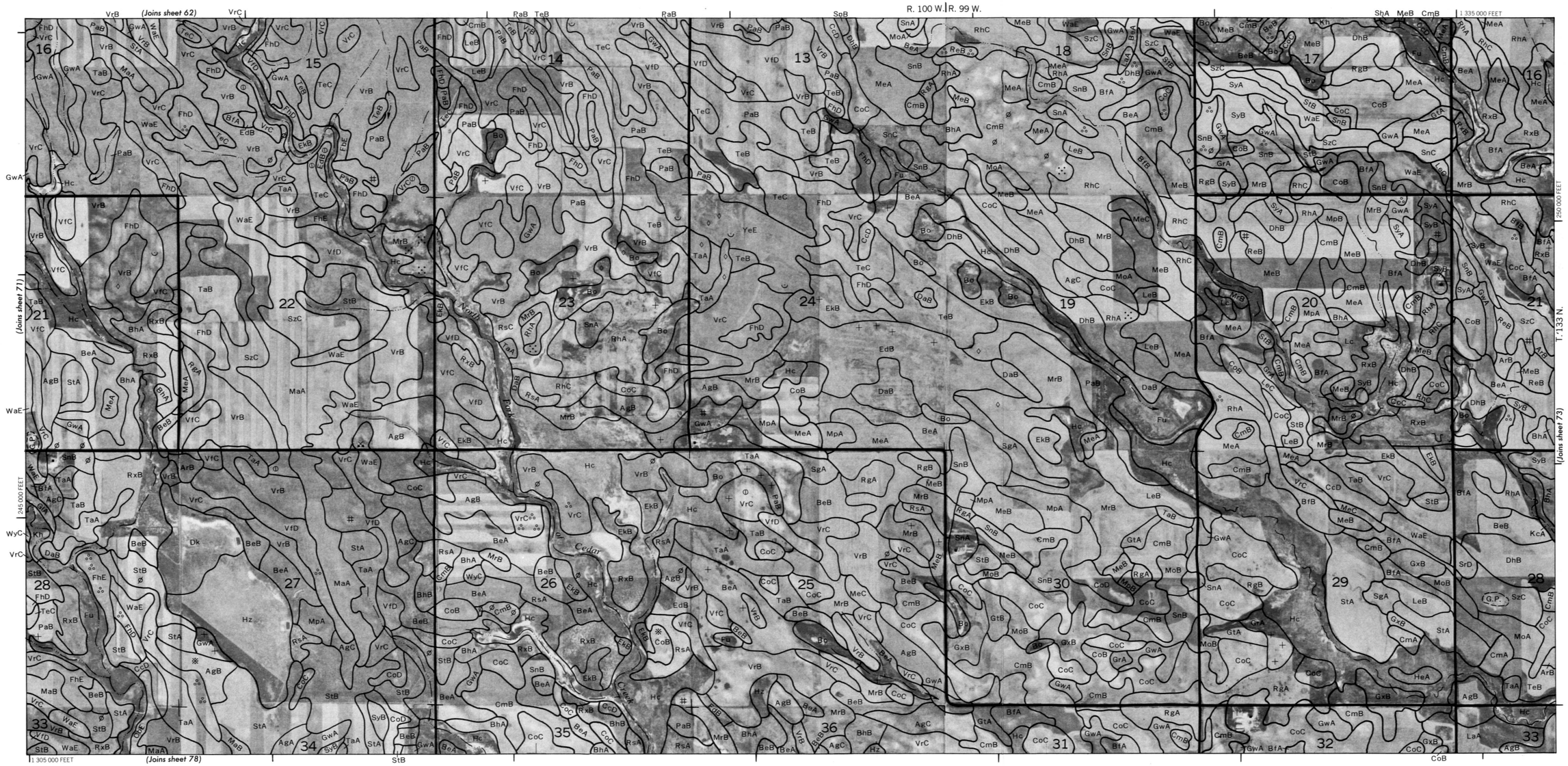


This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 70



SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 72



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

N

SLOPE COUNTY, NORTH DAKOTA NO. 73

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

1 340 000 FEET

250 000 FEET

T. 133 N.

R. 99 W.

R. 98 W.

(Joins sheet 72)

(Joins sheet 63)

(Joins sheet 74)

(Joins sheet 79)

1 365 000 FEET

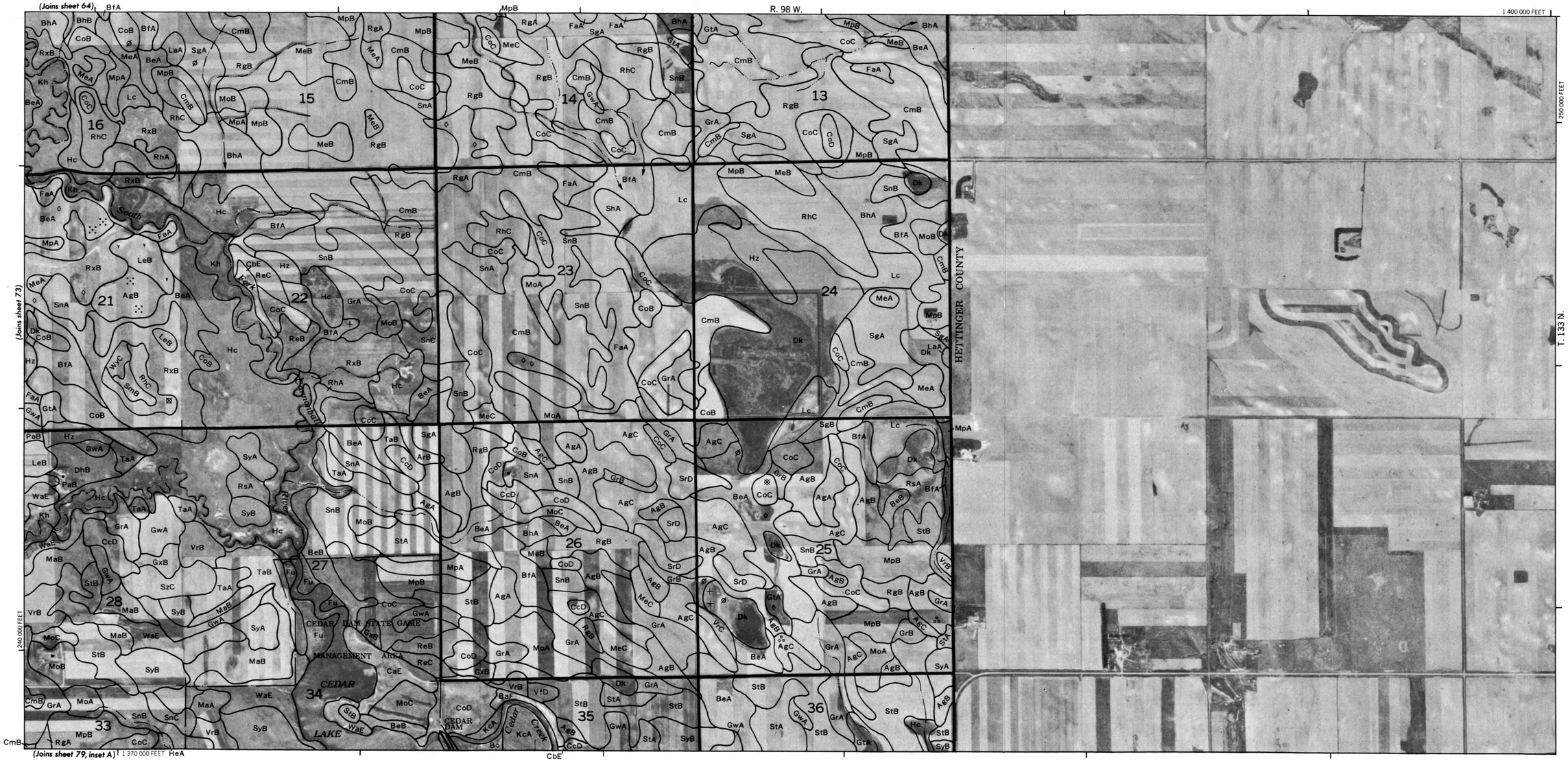
240 000 FEET

1 Mile

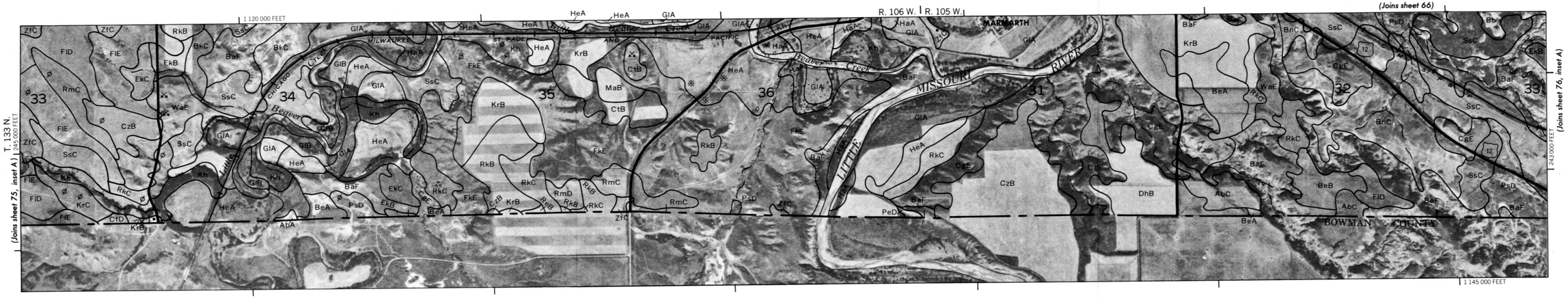
5000 Feet

Scale 1:20000

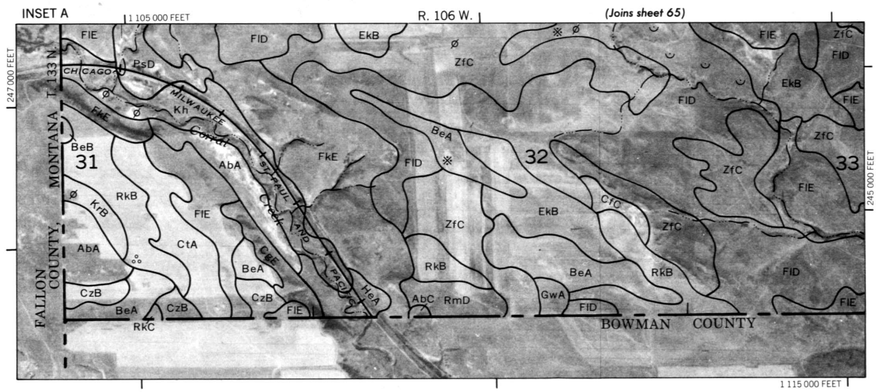
SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 74

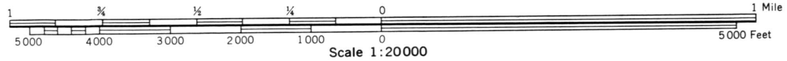


N



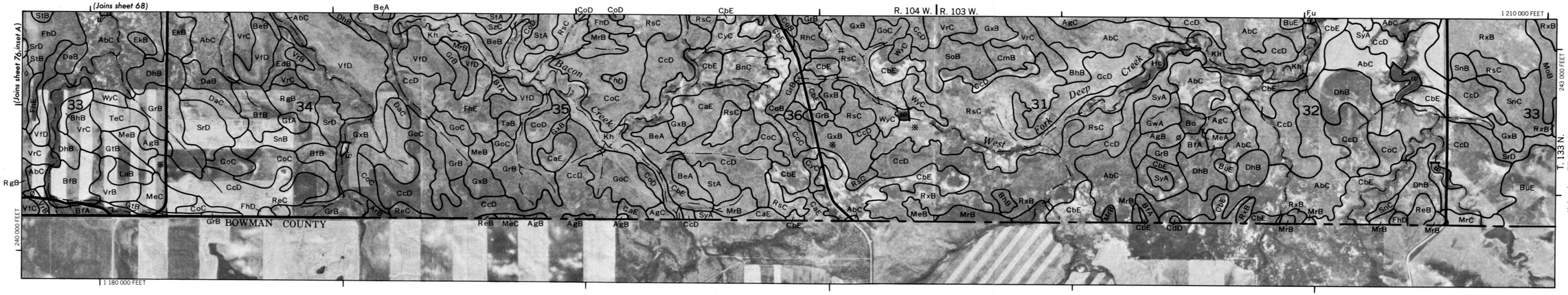
INSET A

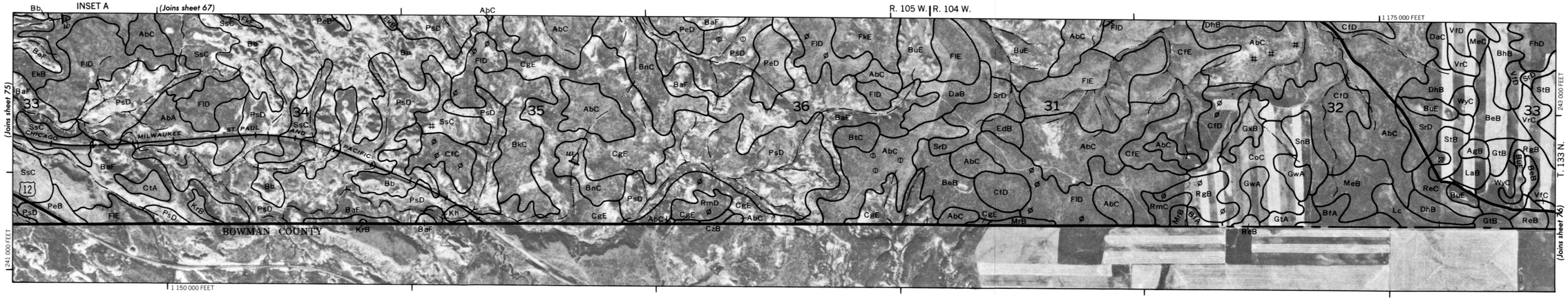




SLOPE COUNTY, NORTH DAKOTA NO. 75

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.





1 ¾ ½ ¼ 0 1 Mile

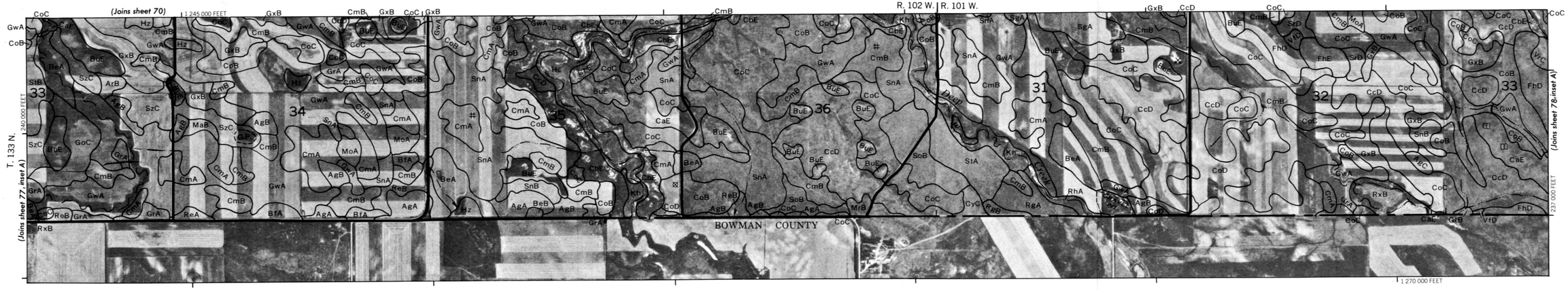
5000 4000 3000 2000 1000 0 5000 Feet

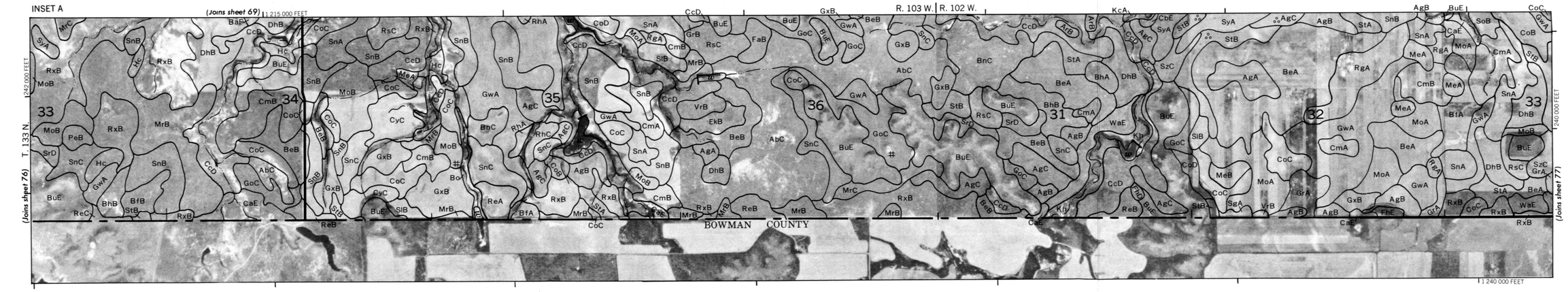
Scale · 1 : 20000

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 76

N





1 ¾ ½ ¼ 0 1 Mile

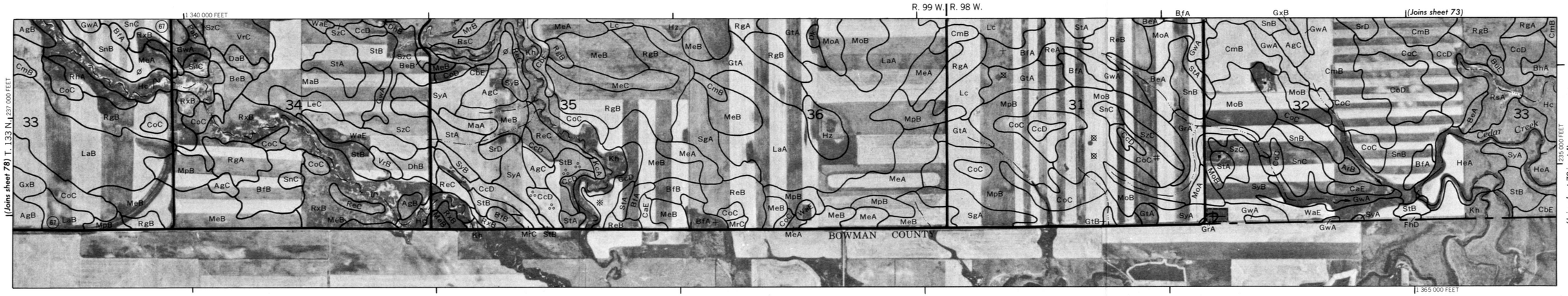
5000 4000 3000 2000 1000 0 5000 Feet

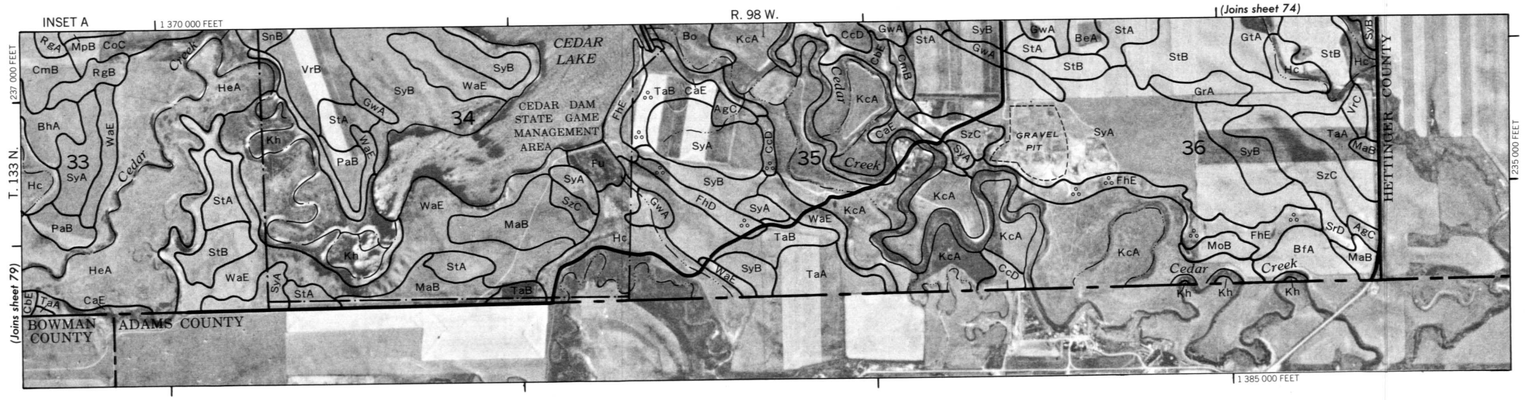
Scale 1:20000

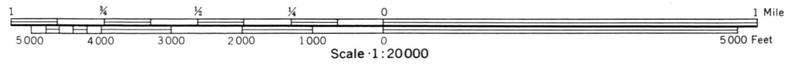
SLOPE COUNTY, NORTH DAKOTA NO. 77

This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1975 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

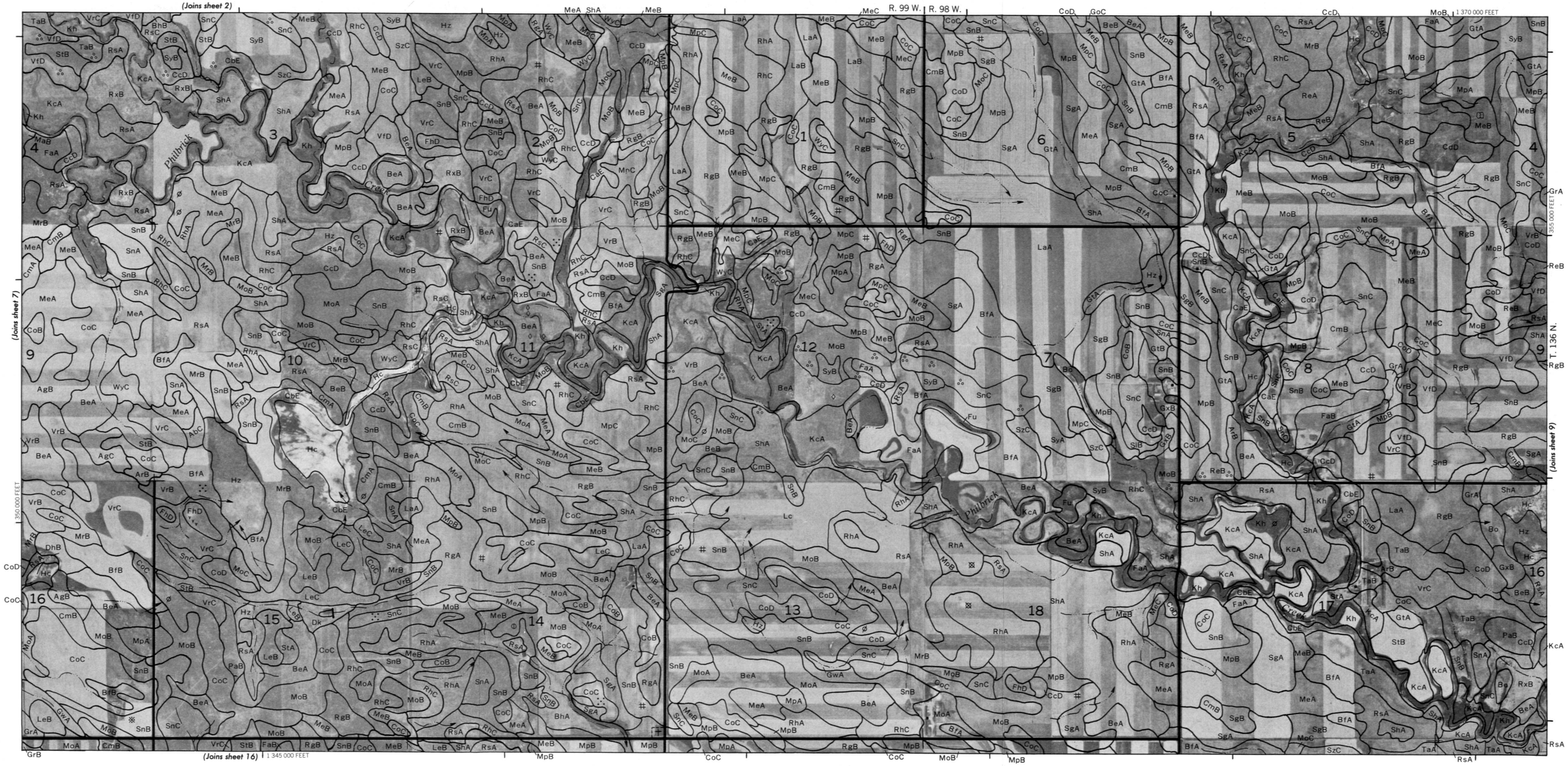
N







SLOPE COUNTY, NORTH DAKOTA — SHEET NUMBER 8



This map was compiled by U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1974 and 1976 orthophotography obtained from U. S. Department of the Interior, Geological Survey.

SLOPE COUNTY, NORTH DAKOTA NO. 8

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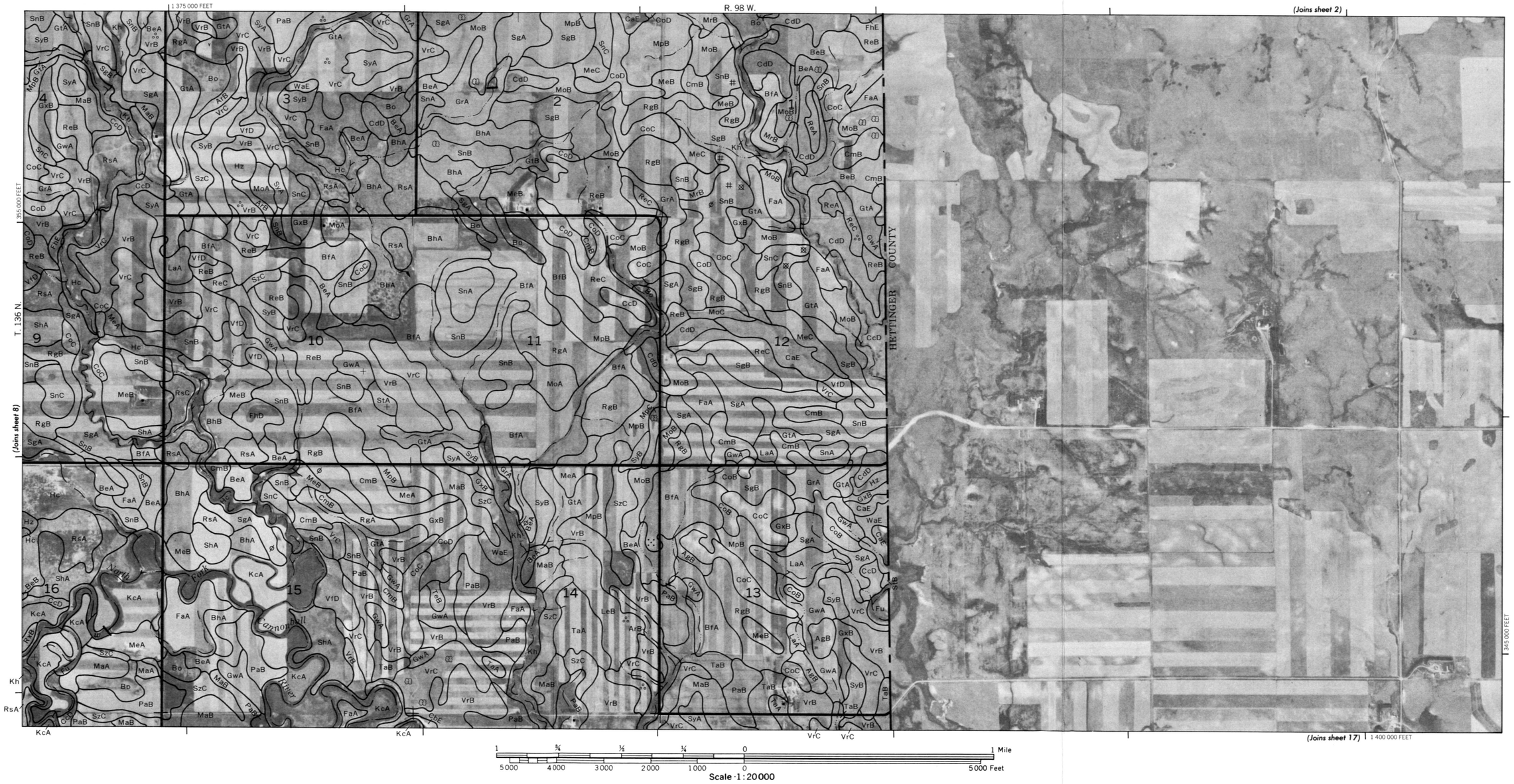


SLOPE COUNTY, NORTH DAKOTA

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

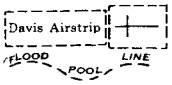
CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool



STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

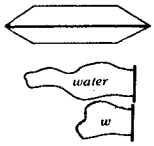
FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small



PITS

- Gravel pit

- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)

- Located object (label)

- Tank (label)

- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

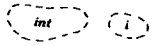
- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)

  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial

- Intermittent

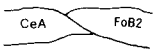


MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS



ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Scoria (porcelanite) outcrop
- Small hill or knoll of sandy soils
- Small hill or knoll of silty or clayey soils